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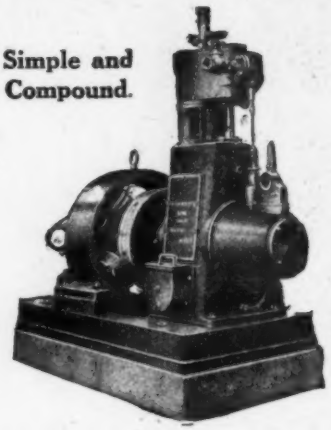

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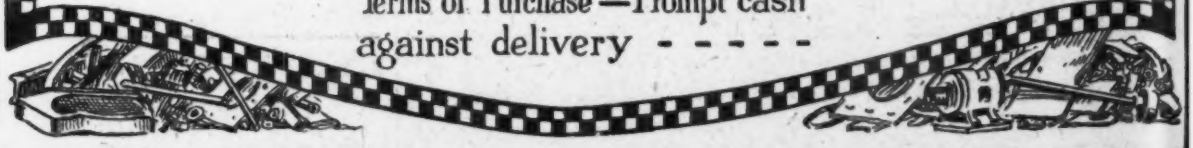

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ELECTRICAL REVIEW.

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Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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PERMANENT PROSPERITY.

THE thoughts of business men in all parts of the world are directed, at the present time, to finding adequate and satisfactory means for the solution of the biggest problem that has yet faced mankind. This problem, which, we repeat, is bigger than anything previously encountered, even during the war, is that of avoiding an era of slackness, unemployment, and misery, which may easily expand into desperation and revolution if proper means of controlling the course of events cannot be found.

The first essential is a full appreciation, and a clear mental picture, of the present situation. The war brought about an immense demand for certain products required for the direct prosecution of warfare—the destruction of the enemy. The manufacture of these direct munitions of war established in turn a demand for apparatus by which that manufacture was to be carried on. This second demand increased the need for raw material. All these sections of industry required larger numbers of workers than formerly, and the demand for workers, taken in conjunction with the demands of the fighting services, caused an unprecedented scarcity of craftsmen available for agriculture, food production, the manufacture of clothing, building, and the general run of ordinary business.

The enormous demand for labour brought with it the necessity for the payment of higher wages, and the scarcity of the necessities of daily existence, due not only to labour shortage, but also to the shortage of shipping and other means of transport, raised the prices of those necessities so that wages, although higher than usual, did not suffice to meet the expense of living. So further demands were made by the wage-earners, and the vicious circle, with which all of us, to our sorrow, are so familiar, was established.

Now, what effect has this war-time situation upon the minds of men at the present time, when warfare has all but disappeared? The increased demand for commodities, due to the raising of the blockade, has tended again to the increase of prices. If prosperity is bound up with high prices, as some writers appear to think, then surely this should be all to the good. But we know instinctively that it is not all to the good that prices shall continue to rise, because that will perpetuate, and make much worse, the vicious circle which we have already mentioned. There is a state of fear throughout all classes and throughout all industry that wages will fall, that the purchasing power of our incomes will still further diminish; and while there are many suggestions for assigning blame and punishment, there are few constructive ideas brought forward. We must increase production; that seems to be an agreed axiom. How can production be increased if we cannot get the men to work? is the reply. The cost of labour is an important item in the cost of the finished product, and if labour is dear the commodity in the production of which it is employed cannot be cheap. Production follows demand, and

prosperity follows production; supply, or production, gives rise to cheapness, which stimulates demand. Now demand not only brings about supply, but, as we have seen, is a direct cause of higher prices, and to maintain cheapness, which is an essential feature of high demand, and, therefore, of prosperity, the supply must always be in excess of the immediate demand.

Thus we have reached a conclusion directly opposed to that which counsels the limitation of production as the means, through high prices, of bringing about prosperity. Demand will itself keep prices as high as they ought to be, and prices which are inflated by means of an artificial limitation or control of supply will tend to defeat their object by reducing the demand. We have said before that successful trading depends on the sale of the finished goods at a price which is higher than the cost of manufacture, but not so high as to cause the consumer to buy something else or to do without the product—to alter his plans altogether. A familiar example will lend force to this hypothesis; electricity for power must be sold at a price which will yield a profit over and above the cost of generation, but which is not so high as to make the consumer put in steam or gas plant, or to abandon the establishment of his contemplated factory.

The excess supply which we have shown to be necessary must be carried as stock, and the rate of production will be regulated at second move through the relation which is observed to exist, from time to time, between the stock and the demand; the stock will, in short, act as a fly-wheel, and steady the load on the engine of production by absorbing shocks, irrespective of the cause from which they may arise.

Some may seize upon the condemnation of the limitation of output to which we have been led, and illustrate it by the practice followed by certain Trade Unions, with a view to furthering the damnation deserved by that practice. Let us not fail to remember, however, that employers and manufacturers do very similar things. The output of diamonds is controlled so as not to cause a slump in prices. Competition in the production of manufactured goods is regulated, and prices are controlled in all branches of industry by the trading combinations, amalgamations, and trusts upon which a Government Commission recently reported.

The current issue of *Industrial Management* contains an article by Mr. G. Sumner Small, entitled "Principles for Stabilising Prosperity." In this article Mr. Small arrives at the conclusion that "there are three means involving Governmental action to avoid or mitigate the effect of business stagnation:—

"1. Utilisation of the reserve purchasing power of the Government to sustain the market.

"2. Providing employment for idle labour on Government work to sustain the purchasing power of the individual.

"3. Equalising the rate of purchase of materials with the rate of consumption through Governmental regulation."

The suggested action of the Government covers, as will be observed, a very wide ground—but how wide is only found on an examination of the whole article. The reserve purchasing power of the Government is to be used to buy stocks of railway material and other supplies required for public improvements; and when users begin to use these stocks and to cease purchasing direct from the manufacturers, then the idea will be for the Government to finance the manufacturers and enable them to continue producing for stock.

Next, employment is to be found for every individual willing to work, on road building, power development, construction of Government buildings, and so forth. Then when existing stocks in the hands of retailers are depleted, buying will begin—the retailers from the wholesalers and the wholesalers from the manufacturers, and these last will then begin to absorb the discharged soldiers and others who, until then, are to be engaged upon the public works aforementioned.

Then purchasing is to be regulated so that there is no excessive loading with stock not likely to be required, and no shortage of goods which are in steady demand. This will have a steadying, or flywheel, effect.

These objects are undoubtedly desirable, but we live in hopes that they will be effected with a minimum of Governmental action. The regulation and licensing of imports into this country has not been so wonderfully efficacious as to set men clamouring for an extension of official management into all branches of our corporate life; and although we are not of those who believe that nothing good can come out of Whitehall, we retain a certain predilection for managing our own affairs in our own particular way. So long as effective aid is there for the use of those who need it, thus ensuring that none need fail for the want of help at the proper time, it is best to let commerce proceed according to its accustomed laws, which have arisen out of the needs of the situation.

Mr. Small makes the statement that business has fallen off in America since the termination of hostilities. We believe that this is contrary to the experience of British manufacturing concerns, many of which are loaded with ordinary work as heavily as they were during the war. Production is down, because labour is not at the pre-war standard of skill, but most factories are working at such a pressure that development is an immediate and pressing necessity.

A New Nationalisation Scheme in Germany.

The downfall of Herr Wissel, Minister for Economy, will probably have the result of bringing about considerable changes in the many German schemes which aim at the nationalisation or socialisation of the industries—only remunerative industries, be it noted—in that country. The fundamental principles put forward by the late Minister in the matter of the systemisation of industries by the creation of a multiplicity of departments, committees, and councils, and of sub-departments, sub-committees, and sub-councils, representing producers and workmen, and consumers of all kinds, down to matters of infinite detail, have not commended themselves to the new Cabinet, which has rejected them; and simultaneously with this result, Herr Wissel and his extremely complicated network of organisation have vanished from the scene.

The first stage of the new *régime* applies to the socialisation of the electricity supply industry, concerning which a new Bill is on the point of being laid before the National Assembly. It is stated that the new Government considers it to be the duty of the State to ensure the supply of electricity in connection with the completely inadequate tonnage of coal available, and for this purpose the Government intends to take over the management of this department of economy, and at once proceed with the construction of high-pressure mains in order to provide an equalisation, as far as is technically possible, between the sources of energy, based partly on water-powers and partly on coal. It is also proposed to transfer to the State the interests of private capital in large electricity works in order to secure for the nation the dominant *rôle* in the production of energy, and the utilisation of water powers will also be

taken in hand by the State so as to equalise the scarcity of black coal by the use of "white coal." However, the electricity works owned by the Free (Federal) States and the communes are to remain in their possession, and they will continue to have the right of disposing of the energy produced in these works, whilst the Free States will also retain the right of disposing of the water powers in their respective territories. In fact, the Government is prepared to co-operate with the States for the promotion of the common object of socialising the supply of electricity.

Although details of the new scheme are not yet available, it is understood that the Bill proposes to confer upon the Government the right of expropriation of all works having a plant capacity of at least 5,000 KW., together with the accessory installations, including high-pressure feeders of 50,000 volts upwards. The compensation to be paid to the owners is represented by the original cost of installation, less provision for regular depreciation, and as a consequence no payment will be made for goodwill.

Sir Arthur and Overseas Trade.

We are glad to learn that Sir Arthur Steel Maitland, Bart., M.P., late Under Secretary of State for Foreign Affairs, additional Parliamentary Secretary to the Board of Trade, and till recently in control of the Department of Overseas Trade, has consented to become a member of the Overseas Committee of the Federation of British Industries. Nobody knows better than the trade Press how keenly interested Sir Arthur Steel Maitland has been in the overseas trade of the country. Perhaps, in the freer atmosphere of the F.B.I., he will be able to continue his work in this connection without unreasonable handicap. It is increasingly obvious that industry has got to help itself. The Federation is, as our own reports of its various activities have shown, doing a great deal to help to develop the export trade of the United Kingdom in co-operation with the Department of Overseas Trade. In many countries of the world it is establishing its own Commissioners. These Commissioners will look after the interests of the individual members of the Federation. They will exhibit their samples, appoint agents, furnish status reports, and send home information with regard to local demands and intelligence.

So far, these Commissioners have sent several million pounds' worth of inquiries to the Federation headquarters in London, and such inquiries have been distributed to the members interested.

Swedish Railways.

It is reported from Stockholm that the Minister for the Interior intends to place before the Rigsdag a proposal for the conversion to electric traction of the State Railway between Stockholm and Gothenburg. The expenditure is estimated at £4,945,000, and the work is expected to be begun next year, if Parliament approves the scheme, and to be completed in three years, on the assumption that one-third of the outlay is voted in each of the three years. It is calculated that energy representing 30,000 KW. will be required, and will be obtained from the Trollhattan and Motalastrom Falls.

The directors of the Gävle-Dala Railway Co. have informed the Swedish Government that they have had prepared an estimate of the expenditure for converting from steam to electrical working the section of the system between Gävle and Falun. As such a conversion is shown to possess economic advantages, the directors have acquired for the company's account a waterfall suitable for the purpose in the form of the greater part of the so-called Rehn Falls in the Ljusne River, in the vicinity of Bollnas, together with the adjoining falls of Humlegard and Danje. The latter are owned by Gävle town authorities, and, in order to secure economical working, the directors propose to co-operate with these authorities in the establishment of a joint generating station, the Government being asked to sanction the acquisition of the necessary lands and rights.

THE COMPILATION OF TRADE PUBLICATIONS.

By E. AUSTIN.

As a means of securing business the value of trade publications, such as pamphlets and catalogues, is well recognised by manufacturers and trading concerns, but what is none too well recognised is the manner in which such publications should be compiled. Large sums of money are spent on work of this kind, and although in many ways pamphlets and so forth leave little to be desired, they nevertheless frequently lack the most essential quality they should possess. Good paper, good printing, and well-made blocks, are of course essential, but what is still more requisite is good and forcible writing. If manufacturers and traders fully appreciated the importance of this their publications would be more effective. As it is the composition is often far from perfect. It lacks the fluency and terseness which good work demands, and as a natural consequence it is dry and uninteresting.

All that need be said could be said in many instances in a much more concise and effective manner. Pages of matter might often be omitted without in any way depriving the reader of information or of running the risk of being outdone by competitors. Prospective purchasers of engineering goods are usually busy men who have not the time or inclination to bother with long and wearisome descriptions. If a machine or piece of apparatus possesses novel features, or is entirely new, then it should be adequately but concisely described. But not infrequently trade publications fail to give the reader the information he most desires. It will often be found on reading, or on trying to read, catalogues, &c., that it is stated that some particular part of a contrivance is of special design, or that its construction is the outcome of years of study and research. What there is special about the particular arrangement, however, is left to the reader's imagination. In nine cases out of ten, there is nothing special about it at all, the idea of calling the thing special apparently being to gain advantage over other firms turning out the same kind of work. But as the dodge has been adopted by so many firms, its advantage, if ever it had one, has long ceased to exist. Equally irritating are the direct and unmistakable endeavours to discredit the productions of competitors. It often happens that firms making the same kind of machine adopt different principles and forms of construction. There are, for instance, many firms building steam turbines, but some construct their machines on the reaction principle, and others on the impulse principle, or the two principles combined. As a result it is frequently found, on referring to turbine catalogues, that makers of impulse machines condemn the reaction turbine, and *vice versâ*. It is doubtful, however, if this is conducive to business. Few, if any engineers, are likely to be influenced by a display of antagonism between two rival firms. The prospective purchaser is, as a rule, much more interested in what each manufacturer has done, the repeat orders he has received, the space machines occupy, efficiencies, and things of that sort. What a manufacturer thinks about things produced by his competitors is of little interest to the purchaser, who should be capable of forming his own opinions.

The sooner all engineering firms recognise that the compilation of their publications is a business in itself, the better it will be for themselves and for their clients. Technical writing, like all other writing, is a knack which can only be acquired by practice, and to imagine that practically anyone can prepare a good pamphlet or catalogue is almost as absurd as assuming that a good fitter or turner is necessarily also a good draughtsman. Of course, there are exceptions, and it may happen that an engineering establishment contains someone who might, if he tried, write clear and impressive matter likely to stimulate business, but, generally speaking, it is best to place the work in the hands of an expert. Large engineering firms have their own publicity departments, in which technical writers are employed; but the cost of running

such departments is an item which the smaller firms cannot, as a rule, tolerate. In the absence of someone who can make a good job of a pamphlet or other publication, there are two courses which such firms may pursue. One is to find an outside individual capable and willing to do the work to order, and the other to get new things at any rate, described in the technical Press, and afterwards to reprint such descriptions in the form of pamphlets or leaflets. The latter procedure, which is frequently adopted, is always practicable when manufacturers are desirous of introducing things possessing new features, or when contractors desire to procure properly-worded descriptions of plant they have erected. Live editors and sub-editors (usually half dead) possess the knack of putting descriptions sent to them into good form, and of writing good descriptions of things brought to their notice. It is a great mistake to imagine that because a man has specialised in the development and manufacture of some particular article that he is necessarily the best individual to write upon it. He is undoubtedly the best man to supply the necessary information, but it does not by any means follow that he can put his ideas and experiences on paper. Yet from time to time all sorts of people set out to write upon matters and things in which they are interested, forgetting, or possibly never knowing, that someone more accustomed to writing might do the job very much better. Of course, in some cases real literary skill is scarcely necessary. Specifications, for example, should be clear and concise, but the language need not be vivid or artistic.

The class of publication that calls for the most careful and skilful handling, is that intended to reach the general public. Much remains to be done in the direction of arousing general interest in electrical affairs. By means of pamphlets devoid of unnecessary technicalities, and written in a good popular style, the advantages of using electricity for domestic and other purposes must be impressed upon the public mind. Other methods may, of course, also be adopted, but there is no doubt whatever that much can be accomplished with a skilfully handled pen. Just as Pelmanism is being popularised, so may electricity be popularised if publicity is properly handled. Those interested in the development of electrical engineering must now pursue this work with renewed and ever-increasing vigour. The public must be taught to regard electricity as something inseparable from life, something which cannot possibly be done without. Short, terse, and well illustrated pamphlets should be compiled on every use to which electricity can be put in the workshop, the office, and in the home.

THE EMPLOYMENT OF PETROL-ELECTRIC WAR-SERVICE GENERATING SETS.

By W. T. WARDALE, A.M.I.E.E.

During the war, many small and easily-portable electric generating sets were used for supplying light to bases, hospitals, and field workshops, and some amount of power where necessary and possible. The petrol-electric combination, which had been developed to a high state of efficiency by our leading makers prior to the war, was naturally a good deal in evidence for this class of service. Many of these sets will be sold along with other Government property; and the question arises as to what will be the value of such plant for ordinary commercial use? Some of the sets will be injured past repair, but others will, after a careful overhaul, be fit for many years' useful life.

As this plant can be adapted to burn paraffin, it will make acceptable units for mansion lighting, travelling entertainments which must carry their own lighting plant, and also for village electrical schemes. As self-contained units they possess great advantages for the purposes named; and if a few elementary precautions are taken when the sets are purchased, a good useful generating set may be obtained for a fairly low capital cost—far lower, indeed, than prevailing prices.

The purchase of such sets, however, must be carried out with more than usual caution. The majority of them will not have had the careful handling and shelter from the weather which is at all times desirable for any type of machinery, but particularly for electrical plant. In addition to the above facts, which may be termed the necessary rigorous conditions of field service, there is the carriage from overseas to be allowed for, with the incidental thorough saturation of the windings by the humid sea air. Thus, although the sets may have been fairly well looked after whilst in service, it is not by any means certain that they will be fit for work on being landed on our own shores again, and after lying in storage for some time.

The above considerations, therefore, demand that the price offered for the sets should be well below a moderate figure, and that no set whatever should be purchased unless it has first been run on load for the observation of the purchaser or his consulting engineer. Any other method of purchase will be exceedingly risky; even if insulation tests be taken on the generator, these will be of necessity low, and practically worthless as an indication of whether the machine will, or will not, prove reliable after a protracted drying out. Again, the magneto itself can easily let an incautious purchaser in for a good deal of expense and trouble, whilst nothing short of taking the engine entirely adrift would give any reliable idea as to its state and probable behaviour in service. This routine would be as expensive for the purchaser and vendor as the conducting of a preliminary dry-out and three hours' full-load test—the buyer to pay for the fuel consumed, whether the set was purchased or not.

It may be argued that such a procedure would entail a good deal of time and expense in drying out and running up hundreds of such sets at the various depôts where they were stored; whilst that opinion is not controverted, it cannot be denied that it will be the only safe method. Failing such methods, the speculative buyer will control the market, and, in order to protect himself, will insist on upset prices for large batches of complete, and apparently not seriously damaged, sets. In turn, this attitude may possibly, indeed, probably will, lead to the wholesale consignment of returned sets to the scrap heap to save trouble.

This would be a loss to the nation in the first place, and by depriving many people of the chance of a fairly reliable set at a moderate price, would further hold up business.

Without a dry out and test run, the only safe method of purchasing will be to have a thorough inspection made of the engine and generator, particular attention being paid to the generator and the magneto, and then, after selecting the most satisfactory set available, to forward it to the original makers, with instructions for a thorough overhaul of the engine, and a thorough overhaul and baking of all electrical portions.

Again one will be met with a protest on the score of expense; but this omits the fact that under the absolutely blind conditions of purchase the buyer must insist on a low price. He is not inspecting and buying ordinary second-hand plant which has been carefully housed and reasonably well treated, but plant which, while it has stood up to a few years' rigorous test, may, or may not, be ready to fail in a short time as the result of that rigorous work. Even with reasonably well-cared-for second-hand plant, it often pays to spend a fair amount in having the whole set run over by the makers, as undoubtedly years of life are given to the plant by such overhaul and renewal, where necessary, whilst the working economy is restored, and the total cost still kept below that of new stuff.

One point must not be lost sight of by any prospective user of such plant; that is, that new plant is offered to him tested, guaranteed, and delivered in his works, and erected and set to work, for a lump sum. Thus, with new plant he is cleared of a good many risks and responsibilities,

and has paid for him many charges incidental to the removal of a plant from one situation to another, which an ordinary purchaser who is not a broker seldom realises. One such point may be mentioned—namely, that of being under an obligation to get the purchased plant removed within a specified time, or to pay demurrage; the avoidance of this particular charge is by no means simple to-day, when both rail, road, and sea carriers are about as accommodating as a block of granite.

The suggestion that the sets should be got ready for service and for a trial run at the Government depôt is, perhaps, new, and somewhat bold; but, like most bold policies, it would pay handsomely. Space to carry out this work would not be great, even if four sets were arranged to be dried out or tested at one time; whilst there are plenty of skilled electrical men in the Navy, who are doing but little at the moment, and who would be well employed getting these sets sorted out into good, bad, and indifferent, and thereby doing a considerable service to both the Government and would-be purchasers.

The advantages offered by these sets to the type of purchaser mentioned above are considerable. In such installations, attendance and capital cost are far more vital points than cost of fuel used per unit generated; for in both the country mansion and the somewhat isolated village, electricity, whether in the more usual form of light, or the rather rarer but increasing form of handy and convenient power, is a very valuable commodity, and people willingly pay what seems to the townsman a preposterous price, until all the circumstances of the case are understood, and the fact is realised that rival forms of power and light are often not only more costly, but extremely clumsy and unhandy. Suction gas plant of the smallest size require more humouring, and a better type of man to attend to them, than does an oil engine, whilst they involve extra capital cost, and the disposal of ashes. The larger plant used in the bigger country factories and village schemes are able to employ a more skilled type of man to attend to them, as their larger output not only warrants but necessitates this provision. The small plant, however, must be low in capital cost, must be able to be run without skilled attention, and must have as little as possible to contend with in the way of ash and other refuse disposal.

In such situations these converted petrol-electric sets would be valuable assets provided they were first put in good order; they may have one complexity more than the hot-bulb engine—namely, magneto ignition; but against this fact, it has to be admitted that there is not a country house or village in which a chauffeur cannot be found; and these men can usually furnish all the tuition necessary to enable an attendant to understand magneto ignition.

In conclusion, it may be argued that the imminent extension of electricity supply on a large scale will do away with the necessity for either country house plant or village installations; this idea ignores the fact that there are thousands of villages and estates which will not be reached by the extended systems for the next twenty years; and it is in these places that such sets as are now mentioned may prove to be of value. Perhaps, however, they may all be smashed up by order of the Government, so that new stuff may have to be built and "work found" for people who do not want it.

THE MERZ-PRICE SYSTEM OF CABLE PROTECTION.

By C. W. MARSHALL.

The action of the Merz-Price gear depends on the principle that when a feeder is sound the current is the same at both ends; whereas when it is faulty, there is a difference either in magnitude or in phase between the currents at the two ends. The method of application to feeder protection is shown in the sketch below, fig. 1. One phase only is shown for simplicity. The secondaries of CT_1 and CT_2 are connected in opposition by means of suitable pilot wires. It follows, therefore, that when the feeder is sound there is no resultant E.M.F. in the secondary circuit, and consequently no current flows in the relays. Whenever a fault occurs, however, the balance of the E.M.F. is disturbed, and a current flows in the relay circuit. The magnitude of this relay current depends on the fault current, the nature

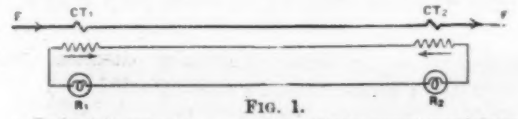


Fig. 1.

F = Feeder to be protected. CT_1 and CT_2 = Similar current transformers.
R_1 and R_2 = Relays to open oil switches at ends of feeder.

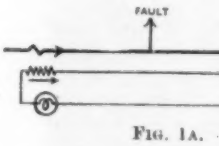


Fig. 1A.

Fig. 1B.

of the fault, and the impedance of the secondary circuit. The designers of Merz-Price apparatus have striven to obtain operation of relays with the lowest possible fault current consistent with stability of operation. The development of the various items making up the gear for a feeder has been almost wholly empirical, and the descriptions given below may be considered as typical of modern installations.

Current Transformers.—The current transformers used for protection differ widely from those used for operating measuring instruments. The primary winding has usually only one turn, while the secondary winding has from 400 to 600 turns. The core is almost invariably provided with a fairly long air gap; otherwise it is of the standard instrument transformer shape and bulk. The objects of utilising this type are (1) to obtain a straight line characteristic with high values of the primary current—*i.e.*, secondary current proportional to primary current over a wide range: (2) to have easy means of getting exact balance between transformers; a first approximation to the desired ratio is got by varying the turns, and exact balance by making small adjustments on the air gaps. The best manufacturers have gone to great expense to ensure that all transformers shall exactly balance, so as to be interchangeable. In other cases, it is considered sufficient to balance in pairs, but in practice this does not work well, owing to difficulties which arise when cables have to be charged or cut into.

Relays.—The relays employed are of the electromagnetic type, as shown diagrammatically in fig. 2. Good class relays

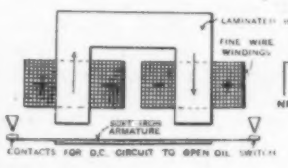


Fig. 2.

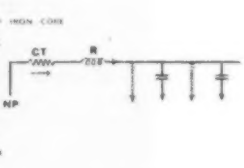


Fig. 3.

have in addition to the fittings shown in fig. 2, some device to indicate when a relay has operated, and also a set of auxiliary contacts of substantial construction in parallel with those shown in the diagram. The most important points in connection with relay design are to ensure high sensitiveness, immunity from operation due to mechanical vibration, and safeguards to prevent the D.C.-contact arrangements from being called on to break the oil-switch trip circuit. The impedance of the relay windings is generally fairly high (about 100 ohms, at 50 cycles per second), and the minimum operating current about 0·1 ampere.

Pilots.—The pilot wires used are generally incorporated in a multi-core cable, which also serves for telephone purposes.

Operation.—While Merz-Price gear has undoubtedly given excellent service in clearing faults on cables, it cannot be said to be perfect. With reasonable attention to the relays, oil switches, and tripping batteries, faults of 100 amperes and upwards can be cleared with certainty, but discriminative action cannot be counted on if the fault current exceeds about 2,000 amperes. These figures show the advisability of earthing the neutral point of all systems on which balanced protective gear is used, as it is generally impossible to clear faults on insulated systems until they have developed to short circuits between phases, in which case the fault current usually exceeds the limit for discriminative action of the gear.

The reasons for operation of gear under large "straight-through" currents in sound feeders are faulty balance of

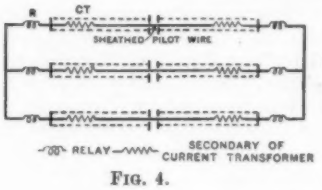


Fig. 4.

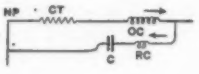


Fig. 5.

current transformers and the passage of the capacity and leakage currents of the pilot cables through the relays. (See fig. 3.) With careful design and manufacture the balance of the transformers could be greatly improved as compared with the present standard, and it should be possible to obtain satisfactory operation at 5,000 amperes or more without any sacrifice of sensitiveness of relay operation.

Capacity-current troubles have generally been met by having high settings on the relays on long feeders whose pilot wires are of large capacity; but this method is objectionable owing to the loss of sensitiveness. A very ingenious scheme has been introduced by Mr. J. R. Beard, which completely eliminates the pilot capacity current from the relays. This method is shown for a three-phase circuit in fig. 4.

Beard uses sheathed pilots, as shown above, the sheathing being open-circuited at the middle of the cable. Each current transformer then supplies half the capacity current between the cable and sheath, and as the relays are situated at the neutral points, no current flows through them. On very long lines, where such a system as the above would be used, there is a possibility of unbalancing, due to the capacity of the power cable, and the sheathed pilot would, of course, be of no value in counteracting this. The capacity current of the power cable is, however, a function of the line voltage, and could accordingly be readily allowed for.

The principal disadvantage of Beard's system lies in the extra cost of the pilot wire, and it would only be justified in the case of a very long new cable where split-conductor protection could not be adopted. The writer is of the opinion that the best method of improving Merz-Price balanced voltage gear lies in the use of biased relays. His scheme is shown diagrammatically in fig. 5. This figure shows how the standard equipment is varied by the use of a special type of relay provided with a restraining coil in addition to the operating coil. The current in the restraining coil is proportional to the voltage induced in the current transformer secondary, and therefore varies with the primary current. Hence it follows that when a feeder is sound and the current transformers are opposing each other, sufficient current flows through the restraining coil to counteract any out-of-balance or capacity current flowing in the operating coil. On a faulty feeder the secondary voltage is comparatively low, owing to the fact that the current transformers are operating on a comparatively low impedance circuit, so that the restraining coil does not decrease the sensibility of the relays to a great extent. The design of the biased relay is, of course, a much more difficult matter than that of the simple relay usually employed, but the greatly increased stability of operation gained by its use should justify the additional trouble, and the extra cost is negligible.

THE DELON RECTIFIER IN AGRICULTURE.

In our issue of December 6th, 1918, we gave particulars of the experiments on the stimulation of plant growth by the electric discharge at Llantwit Vadre, under the supervision of Mr. W. A. Chamen and his assistant, Mr. C. T. Allan, and referred to the use of the Delon rectifier for obtaining high-pressure direct current. The supply was 400-volt, 25-cycle, single-phase current, stepped up by an oil-immersed 10-K.V.A. transformer to 32,000 volts, and rectified with the Delon apparatus, which gave no trouble at all, and kept the pressure up to 39,000 volts in dry weather, and 30,000 volts in wet weather. The accompanying illustrations, for which we are indebted to Mr. C. T. Allan, show the apparatus in position; we understand that it was lent by Messrs. Callender's Cable and Construction Co., Ltd.

Fig. 1, compounded of two photographs, shows, from left to right, a starting switch for the motor, and a water resist-

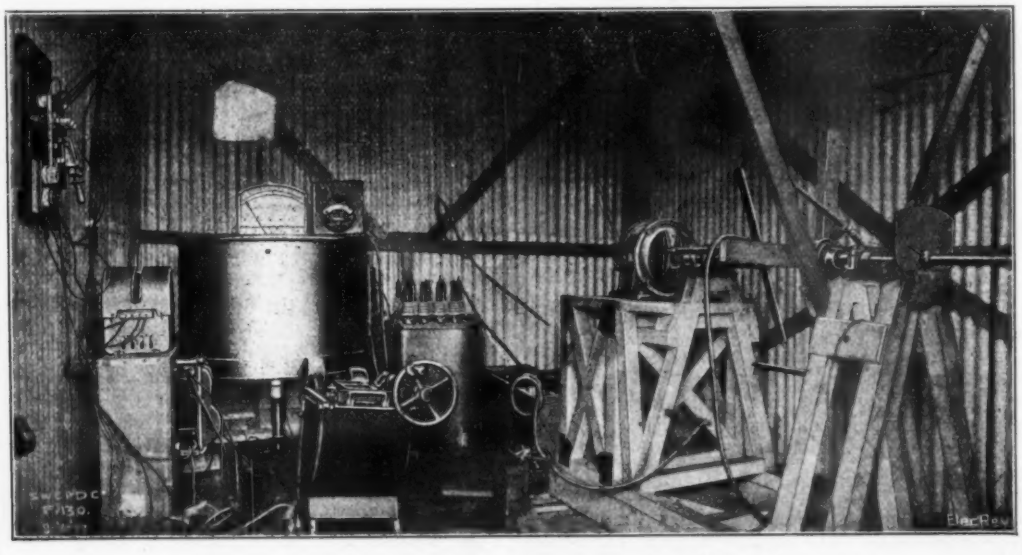


Fig. 1.—Delon Rectifier Outfit.

ance to vary the voltage on the low-pressure side of the transformer; an electrostatic voltmeter reading up to 150,000 volts; step-up transformer, and motor driving the rectifier.

The mechanical part of the rectifier is quite simple, consisting of a shaft coupled to the motor and carrying a single contact maker, an ebonite rod traversed from end to end by a conductor. The rod rotates within a ring of four contacts, two of which are connected to one pole of the transformer, while the other two are connected to

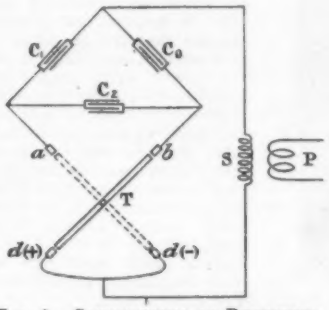


Fig. 2.—Connections of Rectifier.

a system of condensers, as shown diagrammatically in fig. 2, taken from Mr. O. L. Record's paper read before the I.E.E. in 1916.*

The contact-maker does not actually touch the fixed contacts, but passes so close to them that a spark jumps across the gap. The motor is of the synchronous type, and the contacts are so disposed that the contact-maker passes them successively at the moments of positive and negative maximum pressure, charging the condensers. On following out the sequence of operations, it will be seen that the charges in C_1 and C_0 build up at half the rate of the charge in C_2, the charge on which is always equal to the sum of the charges on C_1 and C_0, and if no discharge takes place, the pressure on C_2 will eventually be twice the maximum pressure of the supply. As the frequency of the successive steps is 50 per second, the full charge is very quickly obtained.

One terminal of C_2 is connected to earth, and the other to the network of bare wires suspended over the crop which

Fig. 3.—Apparatus Photographed at Night with Rectifier in Operation.

is being treated. This necessarily involves a loss of charge, and, as above stated, while the double voltage of the supply would be about 90,000 volts, the pressure actually maintained in the case of the Llantwit Vadre installation is from 30,000 to 39,000 volts, D.C. Fig. 3 show the corona effect due to the high voltage.

MOBILE SEARCHLIGHTS.

The most commonly-employed motor searchlight in the Allied service was one having a face diameter of 36 in. and carried aboard a 1½-ton lorry running on pneumatic tires. One such searchlight, built by the Fiat Co., is shown in the accompanying illustration—fig. 2. On this machine the electric generator is mounted above the gear-box, and is driven by means of an enclosed silent chain on the clutch shaft. The body is of a special type, divided into three compartments, the two forward ones accommodating the crew and the rear one receiving the searchlight. This latter can be operated from the interior of the vehicle, or can be lowered to the ground, placed on wheels, and put in the most suitable position 120 yards away from the generating set. For this purpose it is provided with electric cable carried on reels mounted on the side of the car.

Owing to the special nature of the Italian front, it was necessary to develop a powerful portable searchlight which could be hauled over the roads by motor vehicle or animals or used as a sleigh. One of these, built by the Fiat Co., is shown in fig. 1. When it becomes necessary to travel over snow, runners are fixed to brackets specially provided for that purpose, the wheels are taken off, and the sleigh is drawn by mules. On the road the two units can be drawn by horses, or the electric generating set can be put into a lorry which hauls the searchlight trailer.

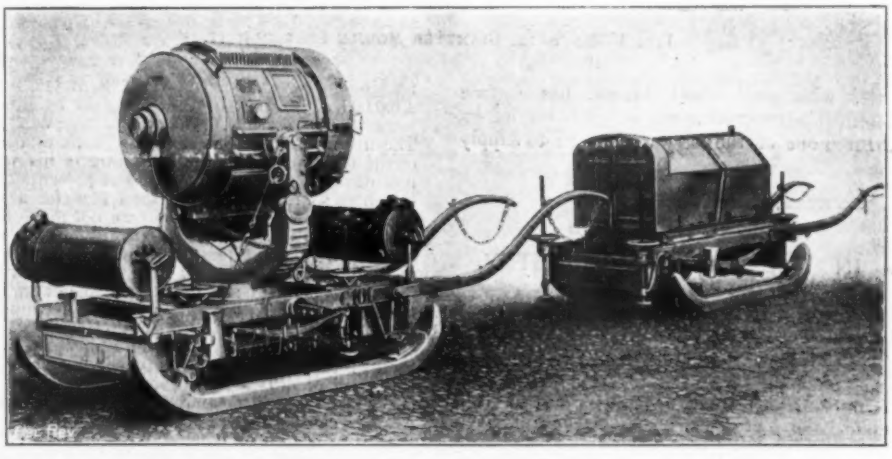


Fig. 1.—Sleigh Searchlight.

* Electrical Review, Febuary 18th, 1916, p. 195.

Searchlights of great power were employed by the various European armies as mobile units to guide aeroplanes back to their landing ground, or to discover enemy preparations. The largest of these lights was carried on special trailers

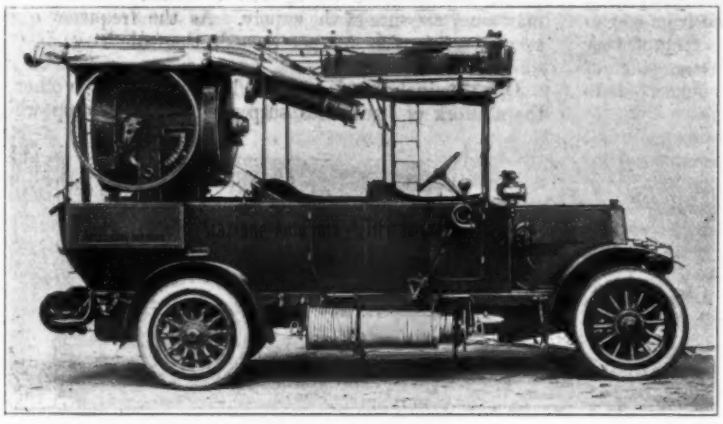


Fig. 2.—A 36-in. Motor Searchlight.

which were hauled by a motor lorry, which in addition carried the electric generating set. The accompanying illustration (fig. 3) shows one of these lights, built by the Fiat Co. The searchlight, which is fitted on a well-sprung

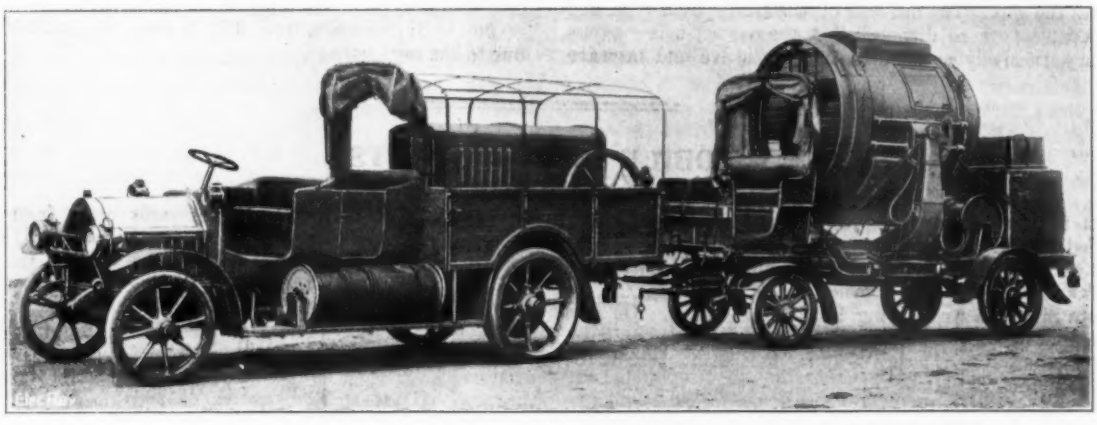


Fig. 3.—An 80-in. Diameter Mobile Searchlight.

four-wheel trailer with rear wheel brakes, has a face diameter of 80 in. The generating set, which is carried on wheels, can be lifted out of the lorry when used to supply energy.

PATENTS IN RELATION TO INDUSTRY.

A Conference on the relation of patents to industry was held at the British Scientific Products Exhibition on Thursday, July 31st, Lord Moulton presiding.

Sir Robert Hadfield, F.R.S., who opened the discussion, said he had come straight from a meeting of a sub-committee of the Federation of British Industries, which was dealing with this question. Through that Federation, and also the British Commonwealth Union, which did the parliamentary side of the work, they would have a very good chance of getting the views of industry put before Parliament in a way which was not otherwise easily possible. The Federation was backing up the views that had been expressed by the Conference of Scientific and Technical Societies, which had already gone into the question in regard to the new Patents Bill, and agreed that there should be a much longer term for the life of patents, that the file-wrapper system should be adopted as was the case in America (the file-wrapper system consisted in allowing an examination of the various remarks by the examiner on any particular application), that a special tribunal should be constituted for dealing with patent actions, and that the term of provisional protection should be extended from six months to two years. He could speak from experience of the value of the file-wrapper system. In Washington, on one occasion, by being able to examine the reports of the examiner on various patents in which he was interested, he had not only saved a considerable amount of time but had been able to avoid costly litigation. It seemed an anachronism in these days to find that a Britisher could not get as good and as long a patent as an American. An American patent commenced, not from the date of application but from the date on which the patent was actually granted, whereas in this country they might waste 12 or 15 months, and all that time the life of the patent was running away. That placed the Britisher very much at a disadvantage. The Federation of British Industries agreed that if fees were reduced by 50 per cent. it would be a very great advantage. With regard to an Empire patent, he agreed with the view of the Federation that it was too late to do anything in that matter in regard to the new Patents Bill. A point which the Federation was introducing was that the publication of a paper before a learned society should not be taken as in any way barring a man from getting a patent. He hoped that the meeting would show legislators that industry was determined to have some change in our patent laws.

Mr. Walter F. Reid, chairman of the Council of the Institute of Inventors, urged the necessity for encouraging inventors, upon which the whole progress of the world depended. Our present system of granting patents, with its limited search of 50 years in this country only, did not give a patentee a monopoly at all; it really gave him a licence for litigation and nothing more. At present the Patent Office made a profit of £100,000 a year out of the fees paid by inventors, and that went to the Treasury. That was a very wrong state of affairs. The inventor was an asset to the State, and as such the State ought to help him at the beginning of his work and not tax him during that period as it did at present. Patents ought to be cheap; in America the total fees for a 17 years' patent amounted to £7. Why should we not make the total fees five guineas? He knew British inventors who went to America because the patent fees there were low and because patents were taken up more easily than they were in this country.

Mr. J. Hunter Gray said he could not understand the attitude of the public towards invention in this country. So far the making of patent laws in this country had been left to Government departments, which always received support from some section of the community which was desirous of getting the work of others for nothing if it possibly could. It was appalling, judging from the newspaper reports of the second reading debate on the Patents Bill ten days ago, that not a single word was said in favour of the inventor, and that all the main questions which should have been discussed for the purpose of improving the position of the inventor were left absolutely alone. To some extent this state of affairs was the fault of the industries themselves which, until recently, had never troubled to represent properly to the Government what the position was and what improvements were necessary.

Mr. Douglas Leechman said that under Clauses 1 and 2 of the new Patents Bill the patentee might, voluntarily or involuntarily, find himself in the position that he had to grant licences to practically any person who liked to apply. If a patentee thought of having his patent endorsed "licences of right" because the Government offered him a bait in the shape of a reduction of his renewal fees by 50 per cent., he would like to draw his very careful attention to these clauses. For

instance, under clause 2, sub-section (d) the "licensee shall be entitled to call upon a patentee to take proceedings to prevent the infringement of the patent, and if the patentee refuses or neglects to do so within two months after being so called upon, the licensee may institute proceedings for the infringement in his own name as though he were patentee, making the patentee a defendant." He would not trust himself to comment upon that sentence. At present when a licence was granted in the ordinary way—an exclusive licence and not a general licence—it was sometimes put in the licence that the licensee should have the right of taking proceedings in the name of the inventor at the expense of the licensee. That was a very different thing to what was now proposed. He was afraid that there was a widespread impression that patent laws were in the interest of inventors, and it seemed to him that when some officials went into the question they looked t it jealously because it might benefit the inventor. That should not be the attitude at all. The point of view, in devising patent laws and in granting patents, was whether it would or would not benefit industry. If they wanted plenty of inventors, and good ones, there must be proper conditions of inducement. Clauses such as the one he had mentioned would not make people invent. He thought it was the most foolish thing in the world for the Government to throw away a whole lot of good inventions, as was being done with regard to the patents which could not be worked during the war. In August, 1914, there were something like 100,000 patents in force. Some of these were in use. Manufacturers were already carrying on business with them, whilst negotiations and contracts were being entered into with regard to others. Then came the control of factories, and the Government, quite rightly, said that the manufacture and development of these patented articles must be abandoned and the factories must go on to munitions. Nobody complained of that, but trade was being injured by the cancellation of a term of the life of these patents. Only a few days ago the manager of one of the biggest industrial undertakings in the country told him that in respect of one patent there were two years still to run, but that it would not pay them to put it on the market for that short period. If they could get back the five years that had been lost, the position would be different. That was happening with hundreds of firms, and they did not know what to do. A number of objections had been raised to a moratorium for patents, the chief of which seemed to be that if they did this for patentees they would have to put everybody else in the same position that they were in before the war, and that, said the Government, was impossible. He had heard no other serious objection, but it was in the interests of industry that this should be done, and he urged that a moratorium for patents should be made the subject of a Bill and passed through Parliament quickly. In some cases a design was even more important than a patent, and everything done for patents should also be done for designs.

Mr. W. M. Mordey, chairman of the Committee of Technical and Scientific Societies which framed the report that was placed before the Board of Trade by the deputation which has been mentioned, said that the great fault of the United States patent system of having full 17 years' patents in every case was that the records of the American Patent Office were simply choked with corpses, patents that even the inventors had lost any interest in and did not wish to keep up. The proposal, therefore, that was put before the Board of Trade was that it was only the renewal fees that should be halved, and not the fees for the first four years. The effect of the present high renewal fees was very serious. Only 40 per cent. of patents survived the first four years, and only 4 or 5 per cent. lived out the full term of 14 years. It had been admitted by Chancellors of the Exchequer that the principle of taxing inventors through their official fees was wrong. Inventors should be taxed through their income tax. That at least would have the advantage that it would not tax the unsuccessful inventor, as the present system did. If the fees were lowered, he believed it would have the effect of increasing the revenue of the Patent Office, because many more patents would be kept alive for their full period. What had been proposed was that the renewal fees for the final ten years of the patent—this proposal was put forward before the new Bill granting 16 years' life was introduced—should be halved, so that the total cost of a 14 years' patent would be £52 instead of £100. He believed that in addition to an increased revenue to the Patent Office there would be a substantially increased national revenue due to the greater activity in the inventing and manufacturing part of the community. He was glad to hear from Sir Robert Hadfield that the Empire Patent Law had received the consideration of the Federation of British Industries, which now represented concerns of a capital value of more than £2,500,000,000; at the same time he was sorry that the Federation thought that no progress could be made in this direction at the present moment. A Committee of the Institution of Electrical Engineers, of which he was chairman, had prepared a report which would shortly be published, in which was outlined a scheme for Empire patents which he believed was a workable and practicable scheme.

Mr. James Swinburne, F.R.S., said that the subject was fifty times more important than 99 per cent. of the subjects that were discussed in the daily Press. The monopolies that were granted to inventors were ridiculously small in proportion to what was wanted in the way of motive to make the country go ahead. One of the fundamental difficulties was the fallacious idea that anybody who made money was robbing the community. He believed that even industrial people had the idea that if inventors were encouraged by granting them monopolies, trade was hampered and that everything the inventor made was taken out of somebody else's pocket. He was afraid that there would always be a strong prejudice against patents because people did not realise that a patentee's royalty was really a very small payment for very big work, work upon which the prosperity of the nation depended. They had already had £2,000,000 granted for scientific research, and he suggested that £2,000,000 might very well be used not only in paying back to inventors that £100,000 a year but in providing money to forward the cause. There should be similar libraries to the Patent Office Library in London in all the large towns of the country. Money spent in that way would do enormous good to the country.

Sir G. Croydon Marks, M.P., regretted with Mr. Swinburne that the daily Press took so little interest in these matters. On the occasion of the second reading of the Patents Bill some of them spoke several columns of Hansard, but the daily papers only gave one or two little paragrahs. He did not hesitate to say that the Bill was practically a new Charter for industry, but it was discussed in an assembly not of 670 or 700 members but in an assembly of 35 members. That showed that the inventing industry or the inventor's relation to the industries of the country was neither appreciated in the House of Commons nor by the Press. It was essential to use every means in their power to waken public opinion to a realisation of the fact that something was being done towards improving the very grave defects of the patent laws of the country. The object of the Bill was to assist industry, and it was incorporated for the first time, although it had always been the theory that patents were granted to assist industry. The Bill laid down the principle that patents were granted not only to encourage invention but to secure that new inventions should as far as possible be worked on a commercial scale. In this way the Bill should bring inventors more into touch with industry than they ever had been before. It afforded a man who could not work his patent means for getting it worked, and it provided means for compelling a man to work his patent—where no steps were taken to work it—through the simple procedure of the Patent Office. The Bill would give a man a patent for six years for £5. There was no other country in the world which gave the same protection at so low a price. The aim of those represented at the Conference should be to study the Bill very closely with a view to improving it during the Committee stage, which would probably be reached some time in October.

Lord Moulton, in bringing the Conference to a close, said that although they had an excellent case, they never seemed to have realised that in order to succeed in getting the modifications of the patent law, some of which had been referred to that day and would be of enormous importance, they would not convince the public until they made the public feel that patents were in the interests of the public. The bulk of inventions were realised even by the inventors themselves to be of no value to the country, and his experience of them was that it would be in the interests of the country to sweep them away. Renewal fees, therefore, were a valuable test as to whether an invention was of substantial value. A man took out a patent on which probably 50 improvements could be made but could not be developed because of the earlier patent. Nobody would take up these improved patents, because it was necessary to get the consent of the man with the first patent to use them. It was to remove that difficulty that the system of compulsory licences was introduced in the interests of the country and in the interests of invention. He agreed with Sir Robert Hadfield that it would be an excellent thing if the files at the Patent Office were always open, as they were in America. One of the things that had done the inventor so much harm in this country was that nothing was considered anticipation that could not be shown to have been published in England, whereas the invention might not be new. He would give an example of the way in which that defect in our patent law was hurting England. Patents came from America and Germany by way of communications, and according to English law the person who communicated them was called the inventor. One of the primary duties of an inventor in drawing up a specification was that he should frankly tell the public the best way he knew to work his invention. It must be drawn up in the utmost good faith between the inventor and the public, in order that when the patent lapsed the public might enjoy the full benefit of the practical use of the invention. But suppose it was communicated through a patent agent: the patent agent was the inventor. The duty applied to him only, but he knew no more of the subject than was in the document itself. The man that really knew was either in America or Germany, and he might have abundant knowledge which he ought to put into the specification and which he would have to put into the specification if he were an Englishman taking out a patent, but because he was abroad—because the so-called inventor was the patent agent to whom the patentee wrote—that basic duty of the patentee to give his best knowledge to the English nation in return for the monopoly granted him became an absolute dead letter. If, in attempting to amend the patent laws, these things which damaged the nation and the commerce of the nation were put forward, he believed that patentees would get generous terms from the nation. One thing the country was determined upon was that the grant of a patent should help the trade of the country and not strangle it. During the last 30 or 40 years

the patent laws of this country had been worked, mainly by people outside—very slightly, comparatively, by people who were Englishmen—solely for the purpose of keeping trade out of the country and strangling the trade of the country. The aim now was to keep the trade of the country flourishing, and no variations of the patent laws would be approved by the public that did not clearly assist the trade of the country. If they could only convince Parliament or the Press or the public that the changes they wanted would bring these patents more quickly and more thoroughly into the life-blood of the industry of the country, they would find no difficulty in getting support.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Government Service.

I unfortunately omitted to read the article referred to by your correspondent, "M.O.M.," but I can bear witness to one department of the Ministry of Munitions.

I was invalided home from France in 1918 and attached to the military establishments branch pending becoming fit again for general service.

I was amazed at the number of robust young men with no special technical qualifications who were still evading military service, although we all supposed they had been cleared out.

It seemed particularly disgusting to one that had seen elderly grey-haired men struggling with pack and rifle in the "salient."

The R.A.F. was the worst offender in holding fit men in soft jobs at headquarters and air stations, and the only ones in that force I have any respect for are those with the "wings" up.

A minimum of work carried on in a maze of red tape was and still is my impression.

Lieut., R.G.A.

August 2nd, 1919.

Vacuum Valve Amplifiers.

In the very interesting article "Vacuum Valve Amplifiers" published in your issue of June 27th last, you state that the vacuum-valves for the wireless telephone sets employed by the British service are "based on the invention of Mr. O. B. Moorhead, of San Francisco, who holds an American patent for the cylindrical anode."

In connection with this I should like to draw your attention to the fact that my company was the first to introduce the cylindrical anode.

Already in the first valve patent No. 24,850, of 1904, by Dr. J. A. Fleming the anode is shown in the drawing and described in the specification as a cylinder.

In so far as valves for generating purposes are concerned my company's patent No. 28,413, of 1913, by H. J. Round contains the following claim:

"A vacuum tube containing a hot filament a grid formed as a closed cylinder completely surrounding the filament and *a third electrode in the form of a cylinder* surrounding the grid."

You will notice that Mr. Round's invention dates back to a time when the use of valves for generating was quite a novelty, and I do not think that Mr. Moorhead's patent (which, I believe, has not yet been published) could have been applied for at an earlier date.

Marconi's Wireless Telegraph Co., Ltd.
GODFREY C. ISAACS, *Managing Director.*

London, *August 1st*, 1919.

The L.C.C. Tramway Staff.

This week the REVIEW's personal column contains a series of items which appears to justify comment. Certain members of the electrical staff of the L.C.C. tramways are announced as being promoted with liberal increases in their salaries, and as I have noticed the names of particular individuals recurring with undue frequency under different labels I am led to the conclusion either that the L.C.C. tramways electrical staff is a crowd of very versatile men or that a sinister variation of "General Post" has great vogue in this most remarkable concern.

About two years ago an electrical engineer was appointed at a salary of £1,500 per annum. In the supply branch of the industry he was an unknown man. This appointment was made as the result of a "reorganisation" scheme, manufactured with the object of obtaining increased efficiency in the tramway service. Since the appointment was made many new offices have been created and filled. In most cases these appointments were not put up for open competition, most probably with the object of making a safe road for the "convenient" man.

Let us take the office of distribution engineer. The electrical distribution on the L.C.C. tramways consists of feeders drawn into ducts and a number of sub-stations containing converting plant; thus it is eminently simple in character. The responsibility for this was divided between two men, each receiving a maximum salary of £600 per annum, *plus* bonuses of 20 per cent. and £90. These were assisted by two groups of officials, each group comprising (*a*) sub-station superintendent, (*b*) sub-station inspector (to help [*a*] do his "bit"), (*c*) mains inspector and a number of foremen.

Last year a mains inspector and a sub-station inspector were announced by the REVIEW as being relabelled sub-station superintendents with salaries of £250-£350 per annum *plus* bonuses. This week they are labelled assistant distribution engineers at £350-£400 *plus* bonuses. Their salaries in their original positions were probably much less than £250.

Last year a sub-station attendant at £2 16s. per week was promoted to mains inspector at £200-£250.

This week he is relabelled mains superintendent at £250-£300 per annum *plus* bonuses. Of course one could go on at great length with this kind of thing, and it forms a most ironical contrast to Mr. Fell's remarks (printed in this week's issue) before the Tramways and Light Railways Association when he said that "at present they endured extraordinary burdens in respect of labour. . . . Unless relief were obtained many undertakings would go under or come upon the rates." Further comment is not required, except that I hope the L.C.C. tramways get the efficiency, the cost of which is apparently hastening to ruin them.

Jonah.

August 1st, 1919.

LEGAL.

BERNERS *v.* C. A. VANDERVELL & Co., LTD.
THE ASKWITH AWARD.

IN the City of London Court on July 29th, before his Honour Judge Atherley-Jones, K.C., an interesting case was heard in which Frank D. Berners, of Bedford Park, sued C. A. Vandervell & Co., Ltd., electrical contractors, of Acton Vale, to recover £82 15s. salary and bonus due.

Lord TIVERTON, who appeared for the plaintiff, said that he was employed by the defendants as manager of their electrical works. On April 5th they gave him a week's salary in lieu of notice, but he ought to have had a month's notice in accordance with the custom of a man of his position in the electrical trade. When he was engaged nothing was said about notice. It might be he was entitled to three months' notice. The plaintiff was employed as the head of the firm's technical staff in the electrical department. On January 7th, 1918, an award was made by Lord Askwith with regard to increasing the wages paid in electrical works, and they were given by his award 12½ per cent. bonus.

Mr. ROOME, defendants' counsel, said the award was never accepted by the defendants, and it had no legal validity. It was not binding.

Judge ATHERLEY-JONES said there were no coercive powers. An Act of Parliament conferred on the Government the opportunity of intervening in disputes between employers and workmen, and they sent Lord Askwith to endeavour to bring about a solution. If the parties liked to submit to the award they could do so, and it was binding because there was then a contractual obligation.

Lord TIVERTON, continuing, said the matter did not end there at all. The defendants had in fact accepted the award and paid their other men under it. For some reason they did not pay the plaintiff.

Mr. ROOME said that was quite untrue. They had not accepted the award.

Judge ATHERLEY-JONES suggested that probably the award applied mainly to workers in electrical shops but not to those in managerial positions like the plaintiff.

Lord TIVERTON replied that it applied to all the technical staff. Plaintiff's position was on the technical staff. He received £5 15s. a week salary and was entitled to a month's salary in lieu of notice as well as the 12½ per cent. bonus.

Mr. ROOME added that the claim to the bonus was certainly not maintainable because ten days after the armistice all the orders which were made under it were repealed.

Mr. BERNERS, the plaintiff, was called, and said he was the assistant head of the defendants' electrical department. His salary started at £4 a week and afterwards was raised to £5 a week and subsequently to £5 15s. a week. The reason given for his dismissal was because the defendants could not afford to keep a man of his ability. He had never had less than a month's notice when leaving similar places. Practically the whole of the defendants' working staff were paid the 12½ per cent. bonus except him. The defendant company had accepted the award. Cross-examined, he said he knew people in the service of the defendants who had been dismissed with a month's salary. He could not be compared with any others because his position was unique. The company had their own generators for the purpose of charging. There were 40 or 50 departments in the defendants' business. The chief of the viewing department received a month's salary when he left. A man named Harrison who was dismissed on Christmas Eve had a month's salary. Defendants sent a circular round the works to all departments stating that he was the assistant chief

of the works electrical department. His salary was inclusive of everything in that he was not paid for overtime. He was not a workman.

Judge Atherley-Jones said it was very difficult to say what was a workman nowadays.

Mr. Roome said a workman was defined by the Munitions of War Act, and it would include the plaintiff.

Judge Atherley-Jones said the term workman was very ambiguous.

Mr. Roome pointed out if the plaintiff was not a workman then the 12½ per cent. bonus certainly did not apply to him.

Lord Tiverton observed that that was a point of law. The award did not mention the word "workmen" at all. The words were "working employé." Lord Tiverton said it would be necessary for the Court to construe the award of Lord Askwith, which was as follows:—

"Under the powers conferred upon me by the War Cabinet I decide that all plain time working employés in generating stations, sub-stations, and on mains directly concerned in the generation and distribution of electrical energy, including the technical staff, and in the case of electrical contractors employés engaged on munition work, including the technical staff, shall receive a bonus as follows:—(1) To workers who have not received more than 20s. war advance the equivalent of 12½ per cent. on earnings. Any advance given by a pending decision of the Committee on Production or any advance given by agreement or otherwise equivalent to the advance of 5s. granted by the Committee on Production to certain trades from the first full pay day in December to be added as a war advance to the advances already given and to count as part of the earnings from the date of such advances. (2) To workers who have received over 20s. war advance, sufficient to produce an equivalent to the 20s. *plus* 12½ per cent. on earnings, that is to say, any excess on war advance over 20s. shall merge in the 12½ per cent. on earnings. (3) Workmen who have received the equivalent of 20s. war advance plus 12½ per cent. on earnings or more are not affected by this settlement. In calculating whether 20s. has been received it shall be taken as 20s. for the normal week as recognised in the district. (4) Basis rates of wages and conditions of labour shall remain as at present until the withdrawal of war wages and war bonuses. This clause is without prejudice to pending negotiations (if any) which may have commenced. (5) This decision shall take effect as from the beginning of the first full pay next after October 13th, 1917."

The plaintiff, in further cross-examination, admitted that he had been paid one war bonus of 12½ per cent., but he maintained that he was entitled to his present claim of an additional 12½ per cent. The defendant company was a controlled Government firm.

Judge Atherley-Jones said if that were the case it was obligatory on the part of the defendants to pay the bonus to those who were entitled to it.

Mr. Roome said it did not apply to the present plaintiff.

The Plaintiff said the bonus which he was claiming was in force at the time he left the defendants' service, and was in force now so far as he knew. He had paid the bonus to men who were under him, and yet the defendants were refusing to give the bonus to him. From June, 1918, to March 31st this year he received £24 13s. 9d. for bonus. He had never given up his claim to the Askwith bonus as distinct from the voluntary bonus which he had been paid. The bonus which had been paid him was paid with the idea of increasing general efficiency, and was a bonus based on the cost of output. The bonus varied each quarter according to the success of the department or rather according to the proportion of the cost and output during each quarter.

Judge Atherley-Jones: It was in the nature of profit-sharing.

The Witness: Yes.

Lord Tiverton: In the nature of a stimulus.

Mr. Stuart A. Curzon said he was formerly chief of the electrical department of the London General Omnibus Co. and formerly of the Motor Omnibus Co. and the Vanguard Omnibus Co. For over 20 years he had had experience in the electrical trade. The minimum notice to which the plaintiff would be entitled was one month up to three months, which was usual, according to the number of men working under the chief. If there were a great number it was three months. Cross-examined, he said his salary was £460 a year with the omnibus company. Whenever he left his employment—he had never been dismissed—he always gave a month's notice. He had an agreement with the omnibus company. In his position three months was usual. He gave that to the Birmingham Motor and Express Co. when he worked for them.

Mr. Mares, from the Ministry of Labour Department, produced the Askwith award.

Mr. Roome said he would very much like to have Lord Askwith there to ask him whether the award applied to a person like the plaintiff.

Lord Tiverton said the answer would be inadmissable, and he did not propose calling the arbitrator to explain his own award.

Mr. Roome submitted that the plaintiff had no right to more than a week's salary in lieu of notice, and that the plaintiff was bound by the award made in the first place by Mr. Churchill.

Judge Atherley-Jones said he really could not understand what the Askwith award meant. The language of Government officials was so extraordinarily cryptic there was no wonder labour troubles were intensified.

Mr. Roome said the defendants were not electrical contractors nor had they generating stations. They did not make their own electricity, but they got it from the mains. He had pointed out that the Churchill award applied to skilled engineers and moulders, but not to others.

Lord Tiverton said the Churchill award had nothing whatever to do with the plaintiff, who was not a skilled engineer.

Judge Atherley-Jones: You look upon this award with the same contumely and disregard that Mr. Roome looks upon the Askwith award on which the plaintiff is relying.

Mr. Roome said when the controlled firms were ordered to pay the 12½ per cent. bonus they could recover it back from the Government. If they had not paid it they would have been prosecuted.

Judge Atherley-Jones said that being the case he could not understand why the defendants were resisting the claim. They would get it back from the Government whether it was proper or improper.

Mr. Roome said they would not get it back from the Government now, and it was not a proper claim; it was so long ago. They were not liable to pay it. There was some protection for the taxpayer he hoped. The electrical fitters got the 12½ per cent. bonus. That was why other people under the plaintiff received the bonus and he did not.

Judge Atherley-Jones said the defendants might have paid the award to people who were not entitled to it.

Mr. Roome said what the defendants paid was paid under statutory authority, whereas the award of Lord Askwith had no statutory authority.

Judge Atherley-Jones said the Askwith award had not been proved as being applicable to the defendants. Defendants would have a difficulty in persuading him that a man in the position of the plaintiff was not entitled to more than a week's notice.

Mr. Roome said the defendants paid 12½ per cent. voluntary bonus to those who did not receive the bonus authorised by Statute.

Mr. George A. Steele, defendants' works manager, said he had been with them for eight years. Plaintiff was in sole charge as works electrician for lighting and power. They did not generate electric current. They charged batteries and supplied dynamos, &c. He was under the impression that the plaintiff was engaged as a weekly servant. He certainly was paid weekly. Only one or two were paid monthly, and those were departmental heads. Harrison was dismissed on a week's notice and not a month. Witness knew nothing of Lord Askwith's award until he came into court. It was never served on him, and the defendants were not parties to it. Plaintiff was paid the 12½ per cent. war bonus ordered by Mr. Churchill, but was not entitled to another bonus as well. Plaintiff never asked for the Askwith bonus while with them. It was paid to the working people. Plaintiff received the voluntary award for increasing the output. They gave the Government war bonus to everyone possible, having the Government behind them. In cross-examination witness said they had paid the Churchill war bonus to wiremen, mates, boys and others. Defendants were Government contractors.

Judge Atherley-Jones thought that the Askwith award applied only to manual workers and not to people in superintendence like the plaintiff, and that he was not entitled to the 12½ per cent. bonus. The Askwith award quite overpowered him in his wonderment as to what it really meant.

Lord Tiverton said that the decision would be very far-reaching and important.

Judge Atherley-Jones felt it was very difficult to say what a worker was or was not. Upon further consideration while the evidence was very slender he was disposed to think that the Askwith award covered the defendants' works, but did not include the plaintiff. As the case was the first under the Askwith award he would postpone giving judgment until Friday.

On August 1st Judge Atherley-Jones delivered a considered judgment. He said that the case was certainly important, and it was because he had received very little assistance from the cases cited to him that he had decided to look into the authorities. The main point was whether or not the plaintiff was entitled to receive a 12½ per cent. bonus under the Churchill or Askwith award. He must hold that the plaintiff did not fall within the scope of the employed persons designated therein, as he was not one of the class to whom the Order applied. The Askwith Order was entirely lacking in lucidity of expression as to who or what were the persons and classes of people employed who were entitled to receive the 12½ per cent. bonus. In his judgment plaintiff was not a "worker" within the meaning of the Order. Plaintiff occupied a responsible position, and was certainly not within the category of persons who would usually be in receipt of a week's notice. The payment of wages weekly constituted some *prima facie* evidence in favour of the defendants' contention, but it was not conclusive. If he had claimed more than a month's notice he was not sure that he would not have established his claim. But he held that he was entitled to a month's notice. Therefore judgment must be given for the plaintiff for £22 15s. and costs. If the parties liked to take the view of more intelligent persons sitting in the Divisional Court on both points they would have every facility for doing so.

Mr. Roome asked that the defendants should have the costs on the issue on which they had been successful, but the Judge said he thought that they would be negligible, and were not worth haggling about.

Watson, Marsh & Co. *v.* Cohen.

This matter, which was reported in our issue of July 11th, was again before Mr. Justice Peterson on July 18th. A lengthy discussion ensued, and we are informed that as the result the defendant was called upon by the Judge to give an undertaking that he would abide by the terms of the purchase agreement and covenant entered into by him in August, 1917, pending the hearing of the trial.

Linsdell v. Paignton Electric Light & Power Co.

On July 29th, at Totnes County Court, his Honour Judge Lush Wilson dealt with the claim of Mr. W. Linsdell, proprietor of a picture house at Paignton, against the defendants for the recovery of £30 10s. 2d. paid under protest to the defendants, being an alleged overcharge for the supply of electric current, damages for disconnecting it, and the amount paid for reconnecting the supply. His Honour said it was proved that the defendants issued to the plaintiff printed forms of application for the supply of electricity, either for lighting or motive power. The charge for lighting was in excess of the charge for power. The plaintiff applied for and obtained a meter for installation as a fitted standby to a motor generator, and connected it by wire to a machine called a rotary converter, which was used for the purpose of altering the voltage for the application of proper light to the arc of the cinematograph. The greater part of the energy after passing through coils of wire was used for making light in the arc lantern. The question he had to decide was for which purpose, within the meaning of the contract, the energy obtained by plaintiff from defendants was used. The primary use of the energy when introduced into the machine was for motive power, and he was of opinion that the electricity obtained was used for motive power purposes within the meaning of the contract. He gave judgment for the plaintiff with costs, and certified for 10 guineas for an expert witness. Leave to appeal was given.

Breach of Electricity Regulations.

On July 28th the Palmer Shipbuilding and Iron Co. were fined under Section 136 of the Factory and Workshops Act, 1901, for a technical offence, they having neglected to observe certain provisions of the electricity regulations. In June a painter named Yeats, aged 26, was found dead on an electrical overhead crane at the platers' shed. The medical evidence showed that death was due to electric shock. Mr. Lauder, who appeared for H.M. Inspector of Factories, said that when Yeats went on to the crane at 6 p.m. to do some painting work he was told by the crane driver that some of the wires were dead, but the trolley wires were alive. Mr. Lauder submitted that defendant had neglected to observe the provision of the Act which required the appointment of an authorised person to supervise any danger to an incompetent person.

According to a report in the *Newcastle Chronicle*, Mr. Mundal submitted that the firm were not bound to take further precautions than they had taken. The work, he said, would have been accomplished without any danger, and, so far as painting was concerned, there was no risk from the electrical current and unless Yeats went outside the ordinary routine of his duty the accident could not have happened. The real point of the defence, however, was that defendants were unaware that Yeats was there. It had been arranged that he should do the work during the week end when the current was off, but it appears that he had not finished the work, and, unknown to anyone, he went to complete it on the Tuesday night. He did not take any precaution or inform the electrician, and, moreover, he was warned by the craneman that some of the wires were alive.

The Bench imposed a fine and costs in this case, and on a further charge of having failed to provide access free from danger to the crane driver's platform, they were also fined £5.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Automatic Chemist.

Mr. P. E. Edelman, New York, has patented a system of automatic chemical control which does some routine control work better than a college trained expert can. Products subject to variations in process or from a variable source of supply can be continuously maintained at a desired standard by this system.

Tons of acid which formerly varied over a wide range despite intermittent tests by the plant chemist are to-day constantly kept to close limits in pulp and paper mills by this invention. Dyestuff, soap, heavy chemical, brine electrolysis, and other works can also profitably use this automatic control.

In the case here shown by way of example it is desired to produce a 2 per cent. sulphuric acid mixture from variable sources of supply. Instead of having a chemist make his determination and set the valves by hand, intermittently, electrodes are used, associated with compensated electrical control-circuits which overcome obvious difficulties, to make instantly the proper adjustment as needed to keep the material to a standard. The apparatus is operated by the fluctuations of the material itself. By referring to fig. 1 it will be seen that any variation in the product will itself operate contacts suitably retarded against transient effects to control automatically the cause of the change and restore the normal condition. In the instance illustrated, if the acid solution becomes too strong the electrically operated valve shuts off a corresponding portion of the reagent supply; or, *vice versa*, in case the resultant becomes even slightly too

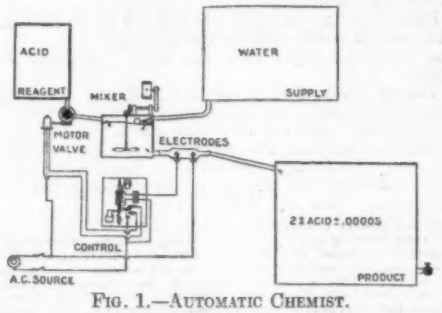


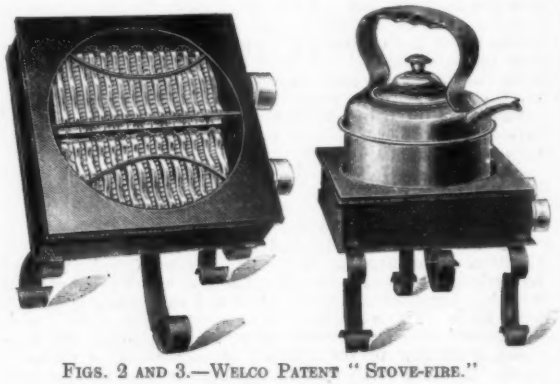
Fig. 1.—Automatic Chemist.

weak. Acid-proof electrodes inserted in the material to be controlled are provided with temperature compensation and thermic control where necessary. The only remaining factor to alter the conductivity between the electrodes is the chemical content. As shown by Kolrausch and others the conductivity varies over almost a straight-line curve within limits for many weak solutions. Other cases have different relations of conductivity to composition, the effects being particularly marked at end points, brine saturation, &c.

The automatic chemist is an assistant and aid to the trained chemist because it relieves him of routine control work and permits delivery of standard products at less cost than by non-automatic methods.—*Scientific American.*

Welco Fire Stoves.

In May last the "Welco Patents," of 150, Alma Street, Birmingham, took over the patents and inventions of Mr. E. A. Welch for convertible fire-stoves, &c., and put the business on a firm financial basis; the commercial side was organised on up-to-date lines, and a new factory is being equipped for the production of the fire-stoves and other equally interesting lines which are in contemplation. The firm has now produced a second model, listed as Nos. 21-26 according to finish (figs. 2 & 3), intended to be used more as a stove than as a fire. The chief points of difference consist in the use of an all-steel body, eliminating the heavy cast-iron front, with a circular opening into which a 2-pint kettle fits, conserving the heat that is wasted in the more ornamental pattern previously marketed. Tests show that two pints of water can be boiled in 9 or 10 minutes with a loading of 1,000 watts.



Figs. 2 and 3.—Welco Patent "Stove-fire."

The makers point out that vessels with highly polished bottoms are not suitable for use on the stove-fire; by giving the bottom a thin coat of dull black a saving of 20 per cent. of the energy can be effected.

B.T.H. Time-Limit Fuses.

The patent time-limit fuse was introduced by the British Thomson-Houston Co., Ltd., Rugby, as a device for obtaining in a simple manner a delayed action in an oil switch, so that the circuit would not be disturbed by momentary faults or temporary over-loads. By a recent improvement it has been possible to extend the range, and fuses are now made in small sizes with reliable fusing points. Experience has shown that small fuses constructed of materials able to give a substantial time limit, of which pure tin is the best, are liable to oxidisation if loaded too near to the fusing point. A thin skin of oxide is able to support the molten metal to an extent which seriously alters the minimum fusing current. This has been dealt with by coating the metal with a material which prevents oxidisation, is not damaged by the minimum fusing current, but softens at the fusing temperature. Fuse links so treated can be made if required in sizes down to an ampere or less, and are as reliable as the larger sizes previously constructed. The new treatment is now given to fuses of all capacities as a guarantee against oxidisation.

The time-limit fuse is connected in parallel with the trip coil of the switch, the trip coil being connected directly across the series transformer which operates it. With this arrangement practically the whole of the current from the transformer normally passes through the fuse on account of the relatively high impedance of the trip coil. Should an overload of sufficient magnitude occur on the circuit, the current will melt the fuse link and then pass through the trip coil, at once tripping the switch. The length of time required for the fuse link to melt is proportional to the heating effect of the current passing through it, so that a delaying action rapidly decreasing with increase of current flowing in the circuit is obtained.

Selective action in the distribution circuits may be obtained by suitably choosing the fuses. By placing a solid link in the clips the overload device is short-circuited and the oil switch

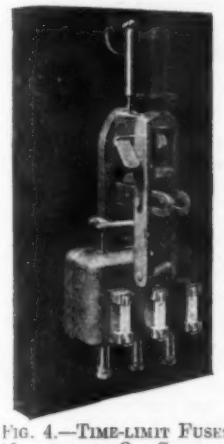


Fig. 4.—Time-limit Fuses Mounted on Oil Switch Escutcheon.

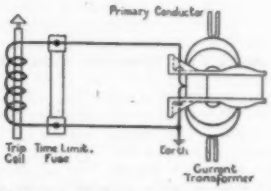


Fig. 5.—Principle on which Time-limit Fuse Works.

then becomes non-automatic. By removing the links from the clips the oil switch will operate instantaneously without any time element. This is useful in emergency conditions. For example, it is possible to try a doubtful feeder with the device arranged to trip instantaneously, finally putting the fuse in circuit when satisfied that the feeder is sound. This will ensure the faulty feeder being tripped out with a minimum disturbance to the system, should a fault develop.

The time-limit fuses are contained in glass tubes with substantial metal ends. The tubes are backed with opal, so that the condition of the fuse is clearly visible against the white background. The fuses are standardised from 1.5 to 30 amperes minimum fusing currents.

Improvements in Fuse Contacts.

Messrs. Frank Thornton & Co., of 16, Bridge Street, Burnley, have sent us particulars of an improvement in electrical switches and fuses which they have patented. As shown in the accompanying figure, it consists in the provision of corresponding burrs and recesses in the contacts, tending to keep the parts securely in position. Some of the advantages claimed for the device are as follows:—The possibility of failure of supply occurring where vibration may cause the dropping out of the replacement bridge of any fusegear is prevented; the

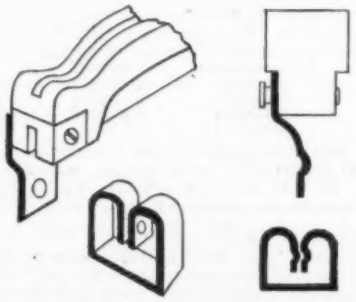


Fig. 6.—Improvement in Fuse Contacts.

insertion of the bridge is attended by a more "positive" action; the improvement can be made in the original stamping process, without entailing any addition to the manufacturing cost; the addition of the burrs and recesses will not affect the current carrying capacity adversely; existing fuseboards can be economically fitted with the new type spare parts; and the improvement will not in any way impede the speedy replacement of a fuse bridge. It is equally applicable to switches of the "Knife" pattern, and may take a variety of forms, of which one is illustrated in fig. 6.

BUSINESS NOTES.

German Activity in Italy.—The much debated discussion as to the possible flooding of the Italian market with German goods is attracting much attention in Genoese industrial circles. Agents who visit the British Chambers of Commerce often comment on the offers coming from Switzerland, ostensibly from Swiss firms, but in reality from German firms who, in many instances, have goods already on the frontier waiting for delivery into Italy. These firms, according to a statement by H.M. Commercial Counsellor at Rome, published in the *Board of Trade Journal*, are willing to give Italian houses three months' credit at 1 per cent. interest, and quote prices for the goods delivered in Genoa, whereas British firms quote f.o.b. London and prices sterling instead of lire. It would be of great advantage to Italian houses if British firms would state prices in terms of the purchasing country. Although the exchange in Italy is still very high, it is thought that in a few months' time the value of the lire will be higher, consequently relieving the present difficult trade conditions between Italy and England. Italy is at present in need of various classes of goods, including chemicals, machinery, and heavy oils.

Prices of Leather Belting.—Hitherto it has been the English custom to sell leather belting chiefly by weight, and, where sold by measurement, leather belting has usually been sold without any specified thicknesses. As both of these systems are open to objection from a buyer's point of view, and have weak points compared with some of the Continental systems, the Federation of Leather Belting Manufacturers of the United Kingdom have decided that, after September 1st no leather belting shall be sold, except on the basis of the new National Price List, which quotes for all widths of belting per ft., with thicknesses specified according to the customers' requirements and the purpose for which the belting is intended. Copies of the new list will be circulated to all buyers in the kingdom before September 1st.

Case-Hardening With Gas.—The Davis Furnace Co. have sent us some data regarding the consumption of gas in case-hardening with one of their special "Revergen" furnaces, which is provided with regenerators of specially efficient design, and is fired with town gas at ordinary pressure, the air being introduced to the furnace at a slight pressure. The material was to be charged into a cold furnace, raised to 900° C., and maintained at that temperature for eight hours to give the necessary depth of case; the work consisted of automobile gear wheels, packed in six boxes, the total weight being 713 lb. The required temperature was attained in 70 minutes from lighting up, the gas required to raise the furnace and charge from cold to 900° being 925 cb. ft., or 1·29 cb. ft. per lb. The average consumption to maintain the temperature was 0·46 cb. ft. per lb., and the overall gas consumption for this run of 9 hours 10 minutes was only 4·8 cb. ft. per lb. of load.

The Yellow Trade Peril.—Addressing the China Association in London, last week, Mr. F. Anderson said that for the last two generations China's foreign trade had nearly doubled every 10 years, and there had been a considerable increase in her manufacturing and mining industries. In this country far too little attention was paid to the future industrial competition of the East with the West. There was a population of 800,000,000 in the East, who were entering into the industrial race. Formerly the West had the advantage of cheap capital, but that advantage had already been lost. Industrial wages in the West were 10 times as high as in the East, and working hours were a great deal shorter. Unless steps were were taken to balance the scale more evenly, sooner or later a difficult position would arise.—*Daily Telegraph.*

Japanese Enterprise in Brazil.—Considerable interest has been aroused in Brazilian commercial circles by the visit to Brazil of the Vice-President of the Chamber of Commerce of Tokio. He has been received at a special session of the Rio de Janeiro Commercial Association, to which he was accompanied by the Japanese Minister. In reply to a speech of welcome he referred in eulogistic terms to the great future which Brazil offered as a market for Japanese manufactures, and stated that on his return to Japan he would endeavour to bring about a visit of Brazilian delegates to that country. The Japanese Minister also addressed the assembly and, in the course of his speech, referred to the monthly service which Japanese steamers already maintained with Brazil, and which would shortly be increased. He also expressed great hopes as to the strengthening of commercial relations between the two countries which would result from the opening of the branches of the Yokohama Specie Bank in Brazil, for which a charter had already been solicited from the Brazilian Government. —*Board of Trade Journal.*

Purchases of Rails in America.—According to the *Financial Times*, Mr. John Hodge, M.P., Secretary of the British Steel Smelters' Union, does not blame the London United Tramways Co. for purchasing American rails from Baltimore. Expressing his views to a Press representative, he said:—"Shipbuilders and bridge builders are all clamouring for steel, and, so far as the tramway company is concerned, you cannot blame them for buying rails in the cheapest market. Everything is against us—the price of coal and the price of raw materials. Labour troubles are having their effect. The only thing is that we ought to protect our own market in the same way as the Americans do."

Our Foreign Business Visitors.—The Foreign Office has notified the Association of Chambers of Commerce that commercial missions, composed of buyers from Chile, Italy, and Switerland, are visiting the principal cities in Great Britain.—*Financier.*

Viscount Milner on Our Industrial Position.—In the course of a debate in the House of Lords, on the second reading of the Finance Bill, Lord Milner, replying on behalf of the Government, said, in regard to the general outlook of our national industry, he agreed that the result of the war had been to bring about more rapidly a position which in any case was bound to be brought about in the course of a certain number of years—that of the industrial predominance or pre-eminence among all the nations of the world of the United States of America. It was bound to come. But Lord Crewe seemed to think that the position of this country in comparison with other great industrial countries had been ruined by the war. If this were the only great industrial country with a heavy debt and an immensely-increased burden of taxation, he would agree that our position had been considerably worsened. But, serious as was our financial position, there was no other country except the United States of America which had anything like the same chance of carrying its burden without an absolutely crushing taxation. It was his profound conviction that, serious as was the country's financial position, it was not a dangerous position, always provided that we remained a constitutionally-governed, progressive nation, and did not go down the terrible road to which some of the Continental countries of Europe were trending ; and in the next place, providing we made the maximum use of the great advantages we possessed in the skill of our work-people and our great scientific achievements. The danger which threatened this country was social and moral, rather than material. By the improvement of our industrial machinery we might attain a yet higher degree of prosperity than we had in the past—not comparatively, because he did not suppose we should ever be the first industrial nation of the world again. In this connection he attached immense importance to the development of our Empire.

Manufacturing in India.—A Calcutta correspondent of the *Times Trade Supplement* issues a warning from India respecting the effect upon foreign markets of attacks on capital at Home. He says that the war has played mischief with our markets abroad, and adds :—"In China the Japanese and Americans have got a firm hold. Here in India we are all out to manufacture locally, and new companies start every week. Thornycrofts are opening a factory here ; Marshalls, the great boiler and machinery makers, are erecting a great factory to manufacture in Calcutta ; Vickers are going to start, in Bombay, a new iron and steel company, and will produce steel girders and plates, &c. ; the Standard Wagon Co. will make railway wagons, and one of the biggest locomotive makers will erect a factory here. Everything is conspiring to make things hard for the home manufacturers, and then one reads of strikes and idleness and a dreadful false prosperity that is really nothing more nor less than mortgaging one's property and then making merry on the proceeds. The only remedy seems to be fair wages from capital and fair work from labour, with real co-operation so that by large-scale production the extra cost may be spread over a larger output."

New Title of the British Westinghouse Co.—The Vickers Electrical Co., Ltd.—The shareholders of the British Westinghouse Electric and Manufacturing Co., Ltd., have received official intimation that the name of the concern as from October, 1919, will be Vickers Electrical Co., Ltd. It will be remembered that at the meeting of the company held in May (see Electrical Review, May 23rd, 1919, page 605), it was stated that the name Westinghouse was to be dropped under the revised agreement entered into with the American company. The adoption of the title Vickers Electrical Co., Ltd., is stated to be the natural corollary from the recent amalgamation of Vickers, Ltd., with the Metropolitan Carriage, Wagon and Finance Co., Ltd., the former company thereby becoming the controlling factor in the affairs of the company. A meeting was called for yesterday, to pass a resolution changing the name of the Westinghouse company as above.

Import Prohibitions.—The President of the Board of Trade and the Leader of the House have been pressed again and again lately to state the Government policy respecting future trade. It is expected that a statement will be made in the course of a day or two now. So far as we have gone, the newest piece of information was given by Sir Auckland, last week, when he said that the prohibitions under which importers were working were limited in time to September 1st. Though he was not yet in a position to state what import policy would be in operation after September 1st, he was prepared to give an assurance that "if restrictions are still in existence, the permissible rate of importation of articles now restricted will be no less between September 1st and the end of the year than it is at the present time."

German Goods for England.—The *Times* for July 30th says that the *Nieuwe Rotterdamsche Courant* learns that an agreement has been made between an important British syndicate and the Dutch trading company, Messrs. Blass & Groenewegen, of Utrecht, with the object of making wholesale purchases of German metal products for immediate export to England. The newspaper adds that this transaction is of great importance for Dutch commerce, because it is apparent that through the continuous rise of the American rate of exchange on London, and the increasing difficulties in industrial life in England, British merchants have been compelled to apply to the Continent for supplies of goods.

Our Export Trade.—In reply to a question in Parliament, last week, the President of the Board of Trade said he was aware of the urgency of re-establishing British export trade to the countries which were not in a position to pay at present by means of exports for essential imports. Sir Auckland, according to the *Times*, said that a scheme had been prepared in consultation with banking and trading interests under which the Government would set up an office to provide sterling credits in approved cases where it was found impossible to obtain sufficient facilities through the ordinary business channels. It was hoped that certain representatives of those interests which had already been consulted would be willing to assist the office in an advisory capacity. Full particulars of the scheme would be made public as soon as certain outstanding points of detail had been settled.

Fire.—It is reported that the offices of Messrs. Balfour, Beattie & Co., engineers, at Clipstone Military Camp, near Mansfield, was destroyed by fire on August 1st.

Electrical Goods in South Africa.—In its comments on the market for electrical goods, the *S.A. Mining and Engineering Journal* for June 28th, states :—"Tubing is even scarcer now than last week and commands practically any price. Dealers are anxiously awaiting stocks which arrived at the coast some 12 to 14 days ago from oversea. In the meantime, in the absence of tubing, a casing made locally of wood is being used as a substitute, which experts state should last 10 or 15 years, although of course its use is expensive in comparison with regular tubing. Country orders are still plentiful, and business is only curtailed by the dearth of tubing." The writer refers to a discussion at a Town Council meeting on June 24th, in reference to purchasing electric lamps to the extent of £2,291. A member in moving that the requisition be referred back, pointed out that the prices quoted were the same in every case. He was aware that a ring existed, but he claimed that it would be broken within a week, so that by deferring the matter it would be possible to secure the lamps at a cheaper cost—for example, lamps quoted at 20s. 6d. a dozen there could be obtained at the coast for from 10s. to 15s. a dozen. The chairman of the Tramway Committee said the purchase was recommended on the advice of the technical experts, who claimed that in view of the fact that the merchants had sufficient stores to meet Union demands for two and a half years prices were as low now as they would be for some time. Eventually it was decided to adopt the recommendation to purchase at the price before-mentioned.

Canadian Trade Statistics.—Statistics laid before the Canadian Parliament by Sir Thomas White in his annual Budget speech, set forth in a very clear and conclusive manner the growth of Canadian trade since 1913. These show that the total trade of Canada more than doubled during the 1913-19 period. The figures, being for merchandise only, are as follows :—

Fiscal year ended March 31st.	Imports for consumption.	Exports (domestic) and foreign.	Total trade.
1913	670,089,066	377,068,355	1,047,157,421
1914	618,457,144	455,437,224	1,073,894,368
1918	962,543,7?6	1,586,169,792	2,548 713,538
1919 (unrevised) ..	916,443,323	1,253,08 ,170	2,139,523,502

During the 1913-19 period Canada's total trade with the United Kingdom was practically doubled, rising from $308,903,639 to $604,950,192. The increase was in exports, which were more than trebled ; imports from the United Kingdom dropped from $138,741,736 to $73,029,215. Figures for trade with Great Britain, are as follows :—

Fiscal year ended March 31st.	Imports for consumption.	Exports (Canadian produce).	Total.
1913	138,741,736	170,161,903	308,903,639
1914	132,070,362	215,253,969	347,324,331
1918	81,807,408	845,480,069	926,782,472
1919 (unrevised) ..	73,029,215	531,920,977	604,950,192

Canada's trade with the United States underwent a remarkable expansion during this period. Indeed, last year her trade with the Republic was equal to 55 per cent. of the total with all countries. Exports more than trebled, while imports from that country were increased by 75 per cent. The totals are as follows :—

Fiscal year ended March 31st.	Imports for consumption.	Exports (Canadian produce).	Total.
1913	435,770,081	139,725,953	575,496,034
1914	395,565,328	163,372,825	558,938,153
1918	791,906,125	417,812,807	1,209,718,932
1919	746,940,654	454,923,170	1,201,863,824

In the fiscal year 1918, Canada's total trade with the British Empire was $1,016,821,857 ; with foreign countries it was $1,485,727,798. In 1919 her trade with the British Empire was $719,990,205 ; with foreign countries it was $1,404,067,033.

Book Notices.—Scientific Paper of the Bureau of Standards. No. 334. "New Forms of Instruments for Showing the Presence and Amount of Combustible Gas in the Air."—This paper contains a description of experimental work upon the combustion of gas at the surface of an electrically-heated wire and the application of this phenomenon to the design of instruments for detecting the presence, or indicating the amount, of combustible gas in the air. Washington : Government Printing Office. Price 15 cents.

"How to Lay-out Turret Lathe Tools." Second edition. Pp. viii + 167 + figs. 166. Coventry : Alfred Herbert, Ltd. Price 6s.

"Steel Structures." July, 1919. Quarterly Journal of the Steel Structural Section of the British Engineers' Association. London : 32, Victoria Street, SW. 1. 6d.

New French Company.—A new company has lately been formed at Fontenay-sous-Bois, near Paris, with a capital of £16,000, and the title La Société des Phares et Equipments Electriques, to manufacture electric lighting sets and other equipment for motor-cars.

Liquidations.—Thompson & Gingell, Ltd., 61, Cheapside, London, E.C., electrical engineers.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors was held, last week, at the offices of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C. Mr. E. H. Hawkins, who presided, stated that at a meeting of the creditors it was decided that the concern should go into voluntary liquidation, and that he and Mr. Taylor should be appointed as the liquidators. In accordance with the wishes of the creditors, the shareholders passed resolutions in favour of voluntary liquidation, and he and Mr. Taylor were appointed as liquidators. According to figures which had been prepared, the liabilities amounted to £3,437, while the assets were set down at £8,125, being made up as follows:—Stock, £3,045; plant and machinery, £719; book debts, £340; motor cycle and sundries, £81; amount due from directors, £212; office furniture, £102; and value of patent, £3,500. The assets were subject to debentures, which had been issued, of £2,000. A receiver had been appointed on behalf of the debenture-holder. Mr. Hawkins said that the company was only registered on March 27th of the present year, with a nominal capital of £20,000, divided into shares of the face value of £1 each. On the day of the registration an agreement was entered into by which Mr. Thompson agreed to transfer a patent to the company, the purchase price being discharged by the issue of fully-paid shares. Mr. Thompson received 10,010 shares, while Mr. Gingell was allotted 6,990 shares. The balance of 3,000 shares were issued to the debenture-holder as a consideration for the advance by him of a sum of £2,000, which was to be used to discharge the formation and other expenses of the company, and he was also to be secured by debentures which were subsequently issued. On July 3rd a petition for the compulsory winding-up of the company was filed by Messrs. Tredegar, the principal creditors. With regard to the money advanced by the debenture-holder, it appeared from the books of the company that £470 was advanced before the company came into existence, in order that certain expenses might be met. The first debenture was issued on April 9th, for £1,000, and at that date £500 of the amount it secured had previously been advanced. In view of the fact that the principal creditors presented their petition within three months of the issue of the debenture, he did not think that the debenture-holder could support a claim to the money he had advanced prior to the debenture being issued. With regard to the shares issued to the debenture-holder as fully paid, the liquidators had taken the opinion of counsel on that matter. They had been advised that shares could not be issued at a discount, and that they should be paid for, and under those circumstances it looked as if the holder was liable to pay £3,000 to the company. The receiver for the debenture-holder was disposing of certain of the assets. The chairman added that he thought action should be taken to test the validity of the debentures and also to settle the question with regard to the creditors. He suggested that the liquidator should be given an indemnity in respect of costs in connection with the actions. The principal creditors stated that they were in favour of action being taken as suggested, and Mr. Hawkins pointed out that if the actions were successful the creditors would probably be paid in full. After a short discussion, the creditors approved of the voluntary liquidation of the company, with the liquidators already appointed, and also expressed the opinion that an indemnity equal to 5 per cent. of the creditors' claims should be given to the liquidators in order that the legal proceedings might be commenced. The following are creditors:—

Fish & Co.	£23	Hampton & Co.	£15
Ward & Goldstone	142	Metal and Hardware Co.	42
K. & C. E. Supply Co.	43	Ballantyne & Co.	15
Gestener & Co.	35	Johnson & Co.	57
Efandem Co.	19	Edison & Co.	87
Tredegars, Ltd.	1,309	Hogan & Wardrop	2·6
Mansell, Ltd.	125	Smith, H. W., & Co.	291
Mackintosh Cable Co.	859		

Richard Wade, Sons & Co, Ltd., Hull.—Winding up voluntarily. Liquidator, Mr. G. S. Y. Ferguson, Hull. Meeting of creditors, August 12th.

Dick's Asbestos Co., asbestos merchants and manufacturers, 47, Fenchurch Street, E.C.—Messrs. W. F. Dick and J. A. Dick have dissolved partnership. Mr. W. F. Dick attends to debts, &c.

Bonus Shares and Super Tax.—In regard to the recent decision in the Courts that bonus shares issued out of profits are exempt from super tax, the Chancellor of the Exchequer says that it is proposed to appeal against this decision.

The B.I.F. at Birmingham.—Attention may be directed to the official and national character of the British Industries Fair, especially the two provincial sections. The municipality of Birmingham and the Chamber of Commerce of that city who, under the auspices and with the support of the Board of Trade, are organising that city's section, are anxious that it should be known that the British Industries Fair (Birmingham) is actually a part of the Exhibition held at the same time (February 23rd to March 5th, 1920) in London and Glasgow. The Birmingham Schedule includes electric light fittings and accessories, table lamps, hall lamps, standard lamps, including appliances and apparatus and glassware appurtenant thereto. Only goods of British manufacture are allowed, and no productions which come within the description named above can be shown anywhere except in Birmingham. The city is allotting all its available public buildings to the Fair. The Council invites early applications for space, and communications should be sent to the General Manager, Chamber of Commerce Buildings, Birmingham. The Fair will be visited by buyers from all parts of the world who have been invited by the Board of Trade.

Catalogues and Lists.—"Z" Electric Lamp Manufacturing Co., Ltd., Southfields, London, S.W. 18.—We have received specimens of postcards, billheads, and labels (advertising the Z lamp), which the company supply overprinted for traders.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. 4.—Pocket booklet entitled "Summary of the Allies' Peace Terms to Germany." Ten pages are devoted to extracts of the terms, two to important events of the war, while the inside and outside back covers make reference to Osram lamps. In this last connection a warning is given that as foreign-made Osram lamps may be offered for sale in this country now that Peace is signed, the purchaser should note that "only Osram lamps bearing the initials G.E.C. are of genuine British manufacture."

British-Thomson Houston Co., Ltd., Rugby.—Descriptive list No. 4,451A gives full particulars of the company's patent time-limit fuses, which are used extensively for industrial purposes and on large power distribution systems.

Messrs. Drake & Gorham, Ltd., 67, Long Acre, London, W.C. 2.—Twelve-page pamphlet (No. 265) containing a fully illustrated account of the "Geyser" electric washer and wringer.

A. C. Cutting and Welding Co., Ltd., 25-27, Theobald's Road, London, W.C. 1.—Brochure giving particulars of portable cutting and welding machines and electrodes, also price list of coated electrodes and machines, with illustrations of work done and testimonials from users.

"Freezor" Electric Fans.—The General Electric Co., Ltd., inform us that they are able to give the trade prompt delivery of the more largely used patterns of "Freezor" electric fans. As is generally appreciated, the difficulties to be overcome by manufacturing concerns in the transition from war work to normal production are very considerable, and especially is this so in the case of the G.E.C. "Freezor" Fan Works at Witton, near Birmingham, where, during the war, the whole of the manufacturing facilities previously devoted to the construction of electric fans were concentrated on the production of material for war requirements. By new and increased manufacturing facilities and by special concentration of effort substantial stocks of several of the most popular types of "Freezor" fans have been accumulated. Included are desk-pattern fans with 9½-in. and 12-in. diameter blades for D.C. circuits, and with 12-in. diameter blades for A.C. circuits. As a ceiling fan the "Koolah" is recommended, and for ventilating large apartments, steamships, restaurants, &c., where a considerable amount of air has to be dealt with, "Freezor" box blade exhaust pattern fans, with blades from 12 in. to 60 in. diameter are available for either D.C. or A.C. The pre-war range of "Freezor" fans is still available, though immediate delivery of the types not specified above cannot be promised.

The Rhine Army and Home Conditions.—Mr. Harry Dubery, Labour Adviser to the National Alliance of Employers and Employed, has just returned from an extended visit to the British Army on the Rhine, where he has been delivering a series of lectures to the troops on behalf of the Education Department of the War Office.

Describing the general attitude of the troops, Mr. Dubery says:—"One found considerably less dissatisfaction among the Army of the Rhine than existed in the Army in France and Belgium last November and December. A great many of those who wanted to be demobilised at that time, have, of course, gone. There is still, however, a keen desire for demobilisation among the bulk of the remainder, but it is substantially modified by the reports of how things are in England: the rank and file feeling that even though they object to the Army, and are anxious to be demobilised, they may, perhaps, drop temporarily into worse conditions because of the industrial unrest at home. The men, as a whole, while not sympathetic with the Labour unrest at home, are certainly not antagonistic thereto, being mainly consumed with a desire to share in the proceeds of the agitation should it be successful. The officers, however, as a class are much more concerned, and bitterly resent a condition of affairs which, they say, makes their re-employment in civil life at a reasonable salary exceedingly difficult, because most of them wish to enter that professional middle-class which has been so hardly hit by the rise in the cost of living—which they hold is at least partly due to the high working-class wages—and the income-tax, while, as a class, it has received less in increases than any other section of the community. They presume, also, that the signs of activity of the re-awakening of industry in Germany, will mean, presently, that the contracts in neutral countries will be lost to Great Britain, and that we shall steadily approach a parlous condition at home in which they will be involved. In spite of this, however, most of them are anxious for demobilisation, and are prepared to take the risks. They reason, many of them, that the Army in peace time keeps them fairly busy all day long on comparatively unimportant matters, and prevents them getting down for several hours at a stretch, to educational schemes which would improve their chances in the professional Labour market."

Bankruptcy Proceedings.—Louis Alfred Thomson, lately trading as Saville & Walton, electrical engineers, 59, Victoria Street, Westminster.—At the London Bankruptcy Court, on July 29th, Mr. Registrar Mellor granted an order of discharge, subject to a judgment for £40. According to the Official Receiver's report, the applicant having served with the Imperial Yeomany in South Africa, returned to this country in 1901, and obtained employment with a firm of electrical engineers. In 1910 he commenced a similar business, without capital, in partnership with one Nield, at Bream's Buildings, Chancery Lane, under the style of "Saville & Walton." Branch businesses were opened at Cardiff and Cobham; thereafter there

was a loss, and in October, 1913 the partnership was dissolved on accounts showing a deficiency of £550 and Nield retiring from the business. The applicant in 1913 removed to 39, Victoria Street; the business was considerably restricted owing to trade disputes; in August, 1914, he joined H.M.'s Forces, leaving the business to his manager, who closed it in May, 1915. The failure was attributed to loss on the trading before October, 1913, and May, 1915, heavy drawings, and loss on a speculation in linseed oil." As offences, the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) trading in knowledge of insolvency; and (3) contributing to the bankruptcy by rash and hazardous speculation. Mr. J. B. Knight, Official Receiver, stated that the sum of £40 had been paid into Court, and he was willing that the bankrupt should now have an immediate discharge. His Honour made an order in these terms.

Non-Ferrous Metal Industry Act.—A list of further additions to licences granted under this Act is published in the *London Gazette* for August 1st.

Glass Control Order.—The operation of the Glass Control (Consolidated) Order, 1917, and the Glass Control (Consolidated) Amendment Order, 1918, has been suspended by the Minister of Munitions, as from August 1st.

Optical Munitions Order, 1915.—The Minister of Munitions has suspended, as from August 1st, the operation of the above order.

Trade Announcements.—Messrs. C. F. Casella and Co., Ltd., scientific instrument makers, have removed to 49-50, Parliament Street, London, S.W. 1, where their head office and showrooms will be situated. Needing larger manufacturing accommodation, they have built a new factory at Walthamstow. After four years of work for Government requirements, they have now resumed private trade operations.

The Millns Electrical Co., of 17, Whitefriars Street, E.C. 4, have been appointed sole London agents for the Arora Co., of Loughborough. Large stocks of the "Arora" fires, boiling plates, &c., for all standard voltages, will be carried in London.

Messrs. Drake & Gorham have disposed of their wholesale trade department to a separate company. In view of the goodwill attaching to the name, permission has been granted to the new company to continue its use, and it has, therefore, been registered as Drake & Gorham Wholesale, Ltd., with registered offices at 67, Long Acre, W.C. 2, to which address all letters relating to wholesale business should be sent.

The Adament Engineering Co. have removed from 14, Market Place, to 11, Halliwell Street, Manchester.

Messrs. Boorne & Co., of 196, Deansgate, Manchester, have been appointed sole representatives for the sale of Messrs. Hamilton, Fould's & Co.'s W.H. Ironclad direct-current motor starters in the territory comprising Manchester and East Lancashire and Cheshire.

Messrs. Guest & Co., electrical engineers, of Rugby, have removed their business to 74-76, Dunchurch Road.

Messrs. A. Verey & Co., wholesale suppliers of electrical and allied manufactures, have taken London offices and stores at 52a, Bow Lane, Queen Victoria Street, E.C. 4. Manufacturers' catalogues and price lists are desired.

LIGHTING AND POWER NOTES.

Bexhill.—Year's Working.—The report on the working of the electricity undertaking for the year ending March 31st last, shows a deficit of £884. Units sold were: private supply, 548,845, against 611,596; public lighting, 12,256, against 8,225; total cost per unit sold, 6·09d., against 5·1d.; total revenue, £13,893, against £13,471; total working costs, £9,377, against £7,869; gross profit, £5,033, against £5,602; interest and repayment of capital, £5,401, against £5,404; total costs, £14,777, against £13,273; coal cost per unit sold, 1·52d., against 1·4d. Consumers connected during the year numbered 35, making the total 1,701; maximum supply demanded was 436 kw., against 503 kw.; and maximum supply installed was 1,150 kw.

Blackpool.—Price Increase.—In view of the increased price of coal, electricity tariffs are to be advanced 40 per cent. above pre-war rates as from October 1st. An increase from 25 to 33 per cent. was made on July 1st.

Strike.—In consequence of a refusal of their demand for increased pay, the electricians and fitters employed in the Corporation electricity works went on strike, on Saturday. The dispute goes back for some time. The men contend that they are receiving less pay than is received for similar work in every other engineering shop in the district from Fleetwood to Preston.

Bolton.—Street Lighting.—Electrical energy required for street lighting in various districts is still being taken from the tramway trolley wires. This arrangement was only intended to operate during the war, and arrangements are now to be made to take the necessary supply from the Electricity Committee's mains.

Price Increase.—From the day of the increase in the price of coal, the price of electricity is to be increased by 0·2d. per unit.

Bradford.—Mains Extenions.—Extension of electric mains have been authorised, and will cost £2,312; also distributing mains, including transformer chamber equipment, £4,200; E.H.T. feeders, including tranformer chamber equipment, £4,203.

Bristol.—Year's Working.—The accounts of the Corporation electricity department for the year ended March 31st, 1919, show gross receipts, £169,313; gross expenditure, £122,226, leaving a gross profit of £47,086, which with £319 transferred from the redemption and sinking fund account, amounts to £47,405; interest and loan charges total £50,821, leaving a net loss on the year's working of £3,416. The credit balance brought forward was £5,155, which with adjustment of income tax (1916-17 and 1917-18) £5,848, gave an available surplus of £11,003, which has been appropriated as follows:—Loss on last year's working, £3,416; allowance to employés with the Forces, £3,869; special expenditure, £1,712; total, £8,997, leaving a balance of £2,006 to carry forward. The report states that the 3,000-kw. turbo-generator referred to in the last report has been out of commission for some months during the year owing to trouble originating with the wet air filters. This has been rectified at the expense of the manufacturers, but the department has lost the benefit of the greater economy which would have resulted had this machine been in constant operation. The new 6,000-kw. turbo-alternator is expected to be working about the end of August. The extension of the buildings at Feeder Road is nearing completion, and the boilers will shortly be erected. Several large and important supplies have been added to the system, and negotiations for many others are in progress. A further increase in the charges has been deferred, but will be brought into operation in rendering the accounts for the September quarter, 1919. It was deemed to be desirable to avoid increasing the charge so long as the additional expenses could be met out of the revenue balances brought forward from the previous year. Units sold amounted to 26,269,745, a decrease of 569,835 units.

Chester.—Year's Working.—The accounts for the year ending March 25th last, show total working expenses amounting to £16,675; balance carried to revenue account, £10,763; gross income, £28,718; net income, £1,206. Expenditure on, and income from, electroculture was £23 and £44 respectively. Total units sold numbered 2,718,891, against 2,917,148; public lighting, 97,579; tramways, 364,749; private consumers, 1,139,574; bulk supply, 1,116,989. Public lamps numbered, 946; maximum supply demanded, 1,410 kw.; number of consumers increased by 43 to 1,855, being equivalent in 8-c.p. lamps to 6,066 and 195,000 respectively. Cost of fuel per unit sold was 0·404d.; wages, 0·214d.; repairs and maintenance, 0·185d.; the total costs per unit sold being 1·86d.

Croydon.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st, show a net surplus of £5,981, or £4,340 in deduction of the loss in 1918 of £1,641. The loss in 1916 and 1917 was £2,007, so that the whole of the loss during the war has been covered. For the present year, owing to increased wages, no surplus is anticipated.

Dundalk.—Year's Working.—The annual report on the working of the electricity undertaking for the year ending March 31st last, shows working expenditure, £7,315, against £5,353; interest on loans, £1,437, against £1,333; sinking fund, £2,250, against £2,290; total charges, £11,002, against £8,975. Receipts amounted to £9,585, against £9,345; gross profit, £2,270, against £3,992; leaving a deficit of £1,417, against a surplus of £370 last year. Total capital expended was £49,114; loans sanctioned, £49,000; and loans repaid, £10,150. Capacity of plant, 740 kw. (exclusive of the battery); maximum load, 559 kw.; load factor, 18 per cent., against 17·9 per cent. Units generated numbered 1,226,234, against 1,090,607; units sold, 880,352, against 790,962; public lighting, 47,568; contract, 15,651; private consumers, 817,133; works cost per unit sold was 1·995d., against 1·621d. There are two storage batteries; No. 1 comprises 126 "Sandycroft" cells, normal capacity, 600 ampere-hours; No. 2 comprises 240 "D.P." cells, normal capacity, 600 ampere-hours. No. 2 is in excellent condition, but No. 1 is in a hopeless state of collapse, and subject to a loan being obtained, all plates of this battery will be entirely renewed before next winter, at a cost of £1,100.

Diesel Engines.—Of the five Mirrlees-Diesel oil engines installed, two are four-cylinder 320 h.p., and three are three-cylinder 150 h.p. Working hours during the year ending March 31st last, totalled 1,778, against 1,634 in the previous year, the total since erection being 4,555. For the year under review the total cost of repairs was £679, against £297; cost per unit sold, 0·185d., against 0·09d.; fuel oil consumed, 408 tons, against 382 tons.

With the exception of No. 1 storage battery, the entire plant is in good running condition, all maintenance charges during the year having been paid out of revenue. The upkeep of the Diesel engines, which formed the bulk of these charges, was exceptionally heavy during the year, due to the use of tar oil as fuel. The operation of the engines with this oil has imposed a constant strain on all concerned with the running of the plant; scarcely a day passed but one or more of the engines had to be shut down due to some defect. The supervision and labour involved in maintaining the engines to give even fairly reliable running is fully 100 per cent. greater than was the case when American crude oil was used. Apart altogether from its deteriorating effects on the various engine parts, the tar oil itself is both dirty to handle and difficult to store. To maintain the oil at a temperature of not less than 60° F. in the storage tank the waste heat in the exhaust gases from the engines was utilised to warm the tank, and has proved entirely successful, and no trouble whatever was experienced during the entire winter of 1918-19 from deposits of napthalene in the oil supply pipes and the pulverisers of the engines. Another trouble experienced during cold weather was the presence of water

in the oil; this has not yet been remedied. Owing to the specific gravities of the oil and water being practically the same, it has been found impossible to separate out the water which forms into pockets that remain submerged at various depths in the oil. Occasionally one of these water pockets emerges into the supply pipe to the engines, and then troubles accumulate. On one evening, about a week before Christmas, at the height of the peak load, only one of the five engines could be kept running, the fuel pumps in all the other engines having become water-logged; had it not been for the storage batteries, the entire town supply would have been dislocated. Troubles from piston seizures also occurred fairly frequently, in spite of the fact that every engine was stripped and thoroughly overhauled twice during the year. On account of the increased heat of the combustion of tar oil, carbonised deposits on the inner surface of the cylinders are much heavier than when crude oil is burned. These deposits clog up the various lubricating passages very quickly; hence the piston seizures. However, these disadvantages were fully compensated for by the saving in cost of tar oil as against what it would have cost if the exclusive use of American crude oil had been continued. During the year, 382 tons of tar oil and 26 tons of crude oil (for ignition purposes chiefly) were consumed, at a total cost, including freight and handling charges, of £2,665. Had a similar quantity of crude oil only been consumed, the total cost would have been 408 tons at 234s. 4d. per ton, or £4,780. The total saving effected by the substitution of tar oil therefore represents £2,115; while, after allowing for extra labour, and for extra wear and tear of the engines and storage batteries, and also for the annual charges of interest and repayment of the amount expended to adapt the engines to burn this oil, the *net* saving represents at least £1,200 per annum.

The substitution early in the year of a special type of pulveriser and flame plate on all the engines effected a considerable reduction in the use of American crude oil for pilot ignition of the tar oil. The special adjustment of the engines were carried out during the March quarter of 1918; throughout this and the two preceding quarters, the proportion of ignition oil consumed averaged 17·9 per cent., while for the succeeding three quarters the average was as low as 2·62 per cent.—a figure which, it is believed, is unequalled on any other Diesel plant in the United Kingdom. The marked increase shown during the March quarter of 1919 was wholly due to the Belfast strike. During that period all supplies of tar oil were suspended, and crude oil had to be used exclusively on all the engines. These rushed change-overs entirely upset the fine adjustments of all engines for some time, but it is hoped to again obtain the best economical running of the engines during the September quarter of 1919.

Ealing.—Price Increase.—The price of electricity is to be increased from 8d. to 10d. per unit.

Elland.—Price Increase.—Owing to the increase in cost of coal, the U.D. Council has increased the charge for electricity to 8d. per unit for lighting and 6d. for power, these figures being a net increase of 100 per cent. on pre-war rates.

Halifax.—Proposed Price Increase.—The Electricity Committee has decided to recommend the T.C. to increase charges for electricity, as follows:—Power accounts under agreement, from 72½ per cent. above pre-war prices, to 102½ per cent.; power, not under agreement, from 60 per cent. to 102½ per cent.; lighting, from 37½ to 75 per cent., or to 7d. per unit; tramways, from 37½ to 77 per cent. The increases, if approved, will date from the September quarter, except in the case of power under agreement, in which the increases will be immediate. The estimated expenditure for the year is about £20,000 more than was originally provided for, and coal is responsible for nearly half of this.

Hereford.—Year's Work.—The annual report for the year ended March 25th, 1919, shows total units sold, 4,050,000, an increase of 1,016,618; units sold for lighting totalled 153,858; power, 1,192,144; and for bulk supply, 2,683,998. Fuel cost £8,974, against £7,921 last year; cost per unit, ·532d., compared with ·624d. for 1918. The tonnage for the year was 8,141, as against 6,436 for the previous year. The average cost of coal into bunkers was 22s. 5d. per ton, as against 24s. 7d per ton for 1918. The average consumption of coal per unit generated was 3·76 lb., per unit sold 4·50 lb., against corresponding figures of 4·30 lb. and 4·73 lb. for the year ending March, 1918. During the year the maximum output was reached in the four months from August to November, over 2,750,000 units being generated at a fuel consumption averaging 2·98 lb. per unit. The experiment in burning low-grade fuel has been successful, as shown by the average cost per ton falling to 22s. 5d., notwithstanding the very great advance in the price of coal. The qualities of coal used in 1918, and purchased then at 9s. 6d. per ton, are now quoted at 29s. 9d. per ton. The new methods have effected a saving of at least £2,984 in the fuel bill. Total revenue, £20,930; working expenses, £16,934; gross profit £3,996, to which must be added proportion of interest and loan repayment charged to bulk supply, making a total of £13,109. After providing for loan repayments and interest (£12,496) and service extensions account, there remains a surplus of £577, which, with £977 brought forward from 1918, leaves a balance to be carried forward of £1,554. During the year £10,485 has been spent on capital account. The cost of generation was £16,934, or 1·003d. per unit, a decrease of 0·10d. per unit, with loan charges added the amount is £29,430, or 1·744d. per unit, compared with 2·120d. for 1918. The average price obtained per unit sold was 1·778d., compared with 2·091d. per unit for 1918; maximum demand, 2,200 KW.; load factor, 21 per cent.

Lancashire.—Wages.—A conference between representatives of the electricity undertakings in Lancashire and Cheshire areas and the Trade Unions having members in such undertakings, was held at Manchester on the 30th ult. It was stated that a National Industrial Council, under the Whitley scheme, had been set up, and it was agreed to set up a District Council. A meeting will be held on August 19th, when the question of basic rates, working conditions, and holidays will come up for consideration.

Leeds.—Coal Strike.—Owing to the coal strike, most of the industrial undertakings are taking a full week or more for the August general holiday. The municipal electricity supply for industrial purposes was suspended from midnight on Friday, August 1st, until Monday morning, August 11th. In cases where private concerns specially need power at any time during the week, it was arranged that this might be supplied on application, each case being considered on its merits. It is probable that some of the big local works will not re-open even after the week's holiday, unless the strike is settled.

Proposed Price Revision.—The scale of charges for electricity is to be increased 20 per cent. from October 1st. The proposal will come before the T.C. in September, and, if adopted, will increase the electricity charges 80 per cent. above pre-war level.

London.—Poplar.—A steam engineer is to be appointed to take full responsibility for the supervision of the boiler house. An improvement of 1 per cent. in the thermal efficiency of the station is equal to £6,000 per annum on the present fuel expenditure.

Hammersmith.—Application is to be made to the L.C.C. for sanction to borrow £49,925, and for an immediate advance of £32,570, being £10,000 for additional boiler-house plant, £15,870 for the powdered-fuel plant scheme, and £6,700 for pulversing-plant house.

The negotiations for the linking-up of the undertakings of the Battersea and Fulham Councils with that of this Council have not sufficiently materialised to enable the scheme to be put into effect to meet the coming winter's load. It is also anticipated that the new steam-raising plant now being installed at the works will not be available to meet the load. The Council has been in communication with the Kensington and Notting Hill E.L. Co. as to furnishing the Council with a subsidiary supply. The company offers an emergency supply during the coming winter season, up to a maximum of 1,000 KW., at actual works cost, plus 10 per cent., but eliminating standing charges. This supply will be required to meet the needs of the "White City" and other consumers in the northern part of the borough. The necessary transformers which will be required to transform the supply from three-phase (Kensington supply) to two-phase (Hammersmith supply) are in stock, and it is estimated that the cost of connecting up the Council's mains to the company's mains at the Wood Lane generating station will be £250. It is recommended that the offer of the Kensington and Notting Hill E.L. Co. for the bulk supply upon the terms outlined above be accepted.

Lytham.—M.H. Inquiry.—The question of the supply of electricity in bulk from St. Anne's to Lytham came before an Inspector of the M.H. on July 29th at St. Anne's on the application of the District Council for sanction to a loan of £13,100. Another inquiry was held on July 30th at Lytham for sanction to a loan of £35,000 for the same purpose. The applications followed upon an agreement made in 1915, and, owing to the greater cost of materials to-day, the increase estimated is over £20,000. Under the agreement St. Anne's is to charge ·5d. per unit; the Inspector pointed out that the charge should be 1·45d. per unit to prevent any loss to St. Anne's.

Manchester.—Proposed Price Increase.—The following increases in the charges for electricity are proposed:—Lighting, 10 per cent., and power 15 per cent. increase. The proposed advances are due to the rise of 6s. per ton in the price of coal. The charges for power are about 85 per cent. above those operating in pre-war days.

Oldham.—Year's Working.—The report on the working of the electricity department for the year ending March 25th last shows a revenue of £88,905, against £79,405; expenditure, £56,408, against £47,479; gross profit, £32,497, against £31,926; net profit, £8,326, against £7,572. Number of 8-C.P. lamps connected, 457,360, against 439,361; units sold numbered: lighting, 1,710,066, against 1,859,520; power, 9,360,725, against 9,636,926; public supply, 24,071, against 33,187; traction, 3,682,955, against 3,653,455. Total units sold numbered 14,777,817, a decrease of 405,271. Works costs were 0·658d. per unit, an increase of 0·115d.; total revenue costs were 0·916d. per unit, an increase of 0·166d. Number of consumers increased by 83 to 2,976; maximum demand increased by 29 KW. to 6,130 KW. (excluding traction), and for traction the maximum demand was 1,450 KW. Length of L.T. distributing mains was 81,572 yards, an increase of 759 yards; length of E.H.T. feeders was 20,944 yards, an increase of 1,409 yards. Capacity of Greenhill generating station on March 25th last was 12,400 KW. Load factor was 25·44, against 22·36 per cent.

Rochdale.—Proposed Price Increase.—It is proposed to raise the tariff as follows:—Lighting, from 6·2d. to 8d. per unit; power, under 15 KW., by from 0·3d. to 0·4d. per unit, according to consumption; over 15 KW., proposed addition of 10s. to the KW. charge, plus ·55d. per unit, compared with 0·5d. per unit at present, plus coal clause; tramways, from 1·45d. per unit to 1·5d., plus coal clause. The increased rates are expected to realise the following amounts: Coal clause, £8,343; lighting, £3,000; power, £2,671; and tramways, £400. The last increase was made a year ago.

Todmorden.—Bulk Supply.—The Corporation has concluded negotiations with the Yorkshire E.P. Co. for a bulk supply for the borough.

Warminster.—Time Extension.—The B. of T. has extended the Warminster E.L. Order, 1914, for three months.

Wimbledon.—Year's Working.—The report on the electricity undertaking for the year ended March 31st, 1919, shows total revenue, £50,560; working expenses, £35,755, or 2·592d. per unit sold, as against 2·015d. in 1918—gross profit, £14,804; after making provision for interest and loan charges amounting to £17,828, there was a loss on the year's working of £3,023. The total average price obtained per unit sold was 3·431d., and the total average over all costs per unit sold, 3·884d. Maximum demand was 1,800 kw., against 2,219 kw. in 1918.

York.—Time Extension.—The York Electric Lighting (Extension Order, 1914) has been extended for six months.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Bill.—The Corporation Tramways Bill authorising the purchase of the Blackpool and Fleetwood Tramroad, was passed unopposed for third reading on July 31st.

Bradford.—Prov. Order.—The city treasurer having reported that borrowing powers for £12,000, for capital expenditure in doubling the tramway track in Thornton Road, could not be granted by the B. of T. or the M. of H., but would have to be obtained by prov. order or Act of Parliament, the Tramway Committee has decided that the expenditure shall be met out of a suspense account, as the work is urgent, and that application shall be made by prov. order or in the next Corporation Parliamentary Bill.

The recent recommendation to abandon the system of collecting upper-deck fares on the footboard, a practice which was established some years ago to save conductors' time, but which, particularly during the crowded wartime days, has proved a cause of inconvenience and delay, has been referred back for certain further inquiries.

Brazil.—Railway Electrification.—According to the *Financier*, the Paulista Railway is seriously considering the matter of electrifying a section or all of its line, while the Brazilian Government is doing likewise in regard to sections of the Central Brazil Railway.

Coventry.—Extensions.—Powers are to be obtained to further extend the tramway system, at a cost of £159,594; the complete scheme is estimated to cost £508,244.

Croydon.—Year's Working.—The annual report on the working of the Corporation tramways department for the year ending March 31st last, shows a total revenue of £183,961 and total expenses of £104,664, leaving a credit balance of £29,297; gross balance, £31,779; interest, sinking fund, &c., £19,225; net balance, £12,554. Traffic receipts increased by £23,408, or 21·37 per cent.; miles run decreased by 210,896, or 9·58 per cent.; passengers carried increased by 831,274, or 3·65 per cent.; working expenses increased by £20,751, or 26·39 per cent.; gross balance increased by £3,410, or 12·02 per cent. Working expenses were £99,378; war allowances, £5,287; total passengers carried, 23,578,514. Renewals fund now stands at £68,769. Energy used for traction, car lighting, and rail grinding was 2,546,382 units, at a cost of 2·364d. per unit, and the total amount paid to the electricity department for energy consumed was £19,858.

Ealing.—Derailment.—A west-bound tramway-car, while descending an incline in Uxbridge Road, last Friday evening, jumped the rails and ran about 25 yards along the pavement. No one was hurt.

Liverpool.—Strike.—The tramway employés struck work on Monday, and the services were suspended. The dispute, it is stated, concerns a question of back pay; the men are demanding 60 hours' pay for the new 48-hours' week. Half the employés are members of the Tramway and Vehicle Workers' Union. These reported for duty, but fearing disturbances, the authorities refused their offer to work a service.

London.—American Rails.—The London United Tramways Co. has been advised that a large consignment of American rails from Baltimore was shipped on July 7th, to relay the track from Acton to Ealing, a work which it is hoped to commence next week.

The London United Tramways, Ltd., are relaying 7 miles of double track on their system from Hammersmith to Brentford, and from Acton to Hanwell, with 2,500 tons of rails supplied by the United States Steel Products, Ltd., at a price, including delivery, of approximately £40,000; 500 tons have been received, and about ¾ mile of track at Chiswick has been relaid with the new rails. Mr. C. J. Spencer, general manager of the L.U.T., explained to a *Daily Mail* representative that, although six British firms were asked to tender for the required rails, only one was in a position to do so. The one tender received was not greatly in excess of the American firm's tender, but it had clauses which would have enabled the contractors to raise the amount of the tender in the event of the cost of labour increasing. In view of labour conditions they were also unable to promise delivery on a definite date. The Americans were able to offer a superior quality of steel, and at a fixed purchase price. The cost of laying the metals will be about £200,000, or £30,000 per mile, as compared with £12,000, the pre-war cost of such work. Other steel rail contracts recently lost to Britain are:—A Birmingham order of £16,750 for steel girder rails placed with the Lorain Steel Co., Cleveland, U.S.A.; a Glasgow order for 5,000 tramway rails from the U.S. Steel Products Co. at £17 9s. per ton; an order for 750,000 tons of steel rails for Northern France offered to British and U.S. manufacturers. The British manufacturers found that when they got down to bare net cost they were 30s. per ton outside the American price.

Accidents.—A serious tramcar accident occurred in Clapham Road on Monday night. A car, with trailer, was halted when it was overtaken by a single car, which collided violently with the trailer. Some 15 people were injured, seven being removed to hospital. Another car jumped the points in turning out of Swinton Street into King's Cross Road on Monday morning, and ran across the pavement into a shop, which was demolished. Passengers escaped with a shaking, but the driver, who remained at his post, was badly cut about the hands.

Strike.—A section of the employés of the London and South-Western Railway declared a strike at midnight on Sunday last. The trouble originated at Nine Elms depôt, where about 500 enginemen and firemen refused to work, ostensibly in sympathy with the police strike. The electric trains were not affected, a service being maintained to places up the river. During Monday morning a few drivers on the City and South London Railway joined forces with their colleagues on the L. & S.-W. line. About a quarter of the drivers were affected; up to 8.30 a.m. no trains were run, but arrangements were later made to run a ten-minute service between Stockwell and Moorgate. The remainder of the line was closed.

Hammersmith.—Communications are to be addressed to the Prime Minister and to the President of the B. of T., stating that the B.C. supports the views of the Barnet Council, that the Government should give immediate consideration to the question of compelling all London railway companies, which have not already done so, to electrify such parts of their lines as serve suburban areas.

Morecambe.—A start has been made in mechanical tramway traction on the Morecambe service, the first of the Tilling-Stevens petrol-electric 'buses, which have been on order for some time, having arrived.

Mossley.—Wages.—The employés of the Ashton, Hyde, and Mossley tramways have sent in an application for an increase of 12s. per week in wages for drivers, conductors, shedmen, and women included.

Southgate.—Electric Vehicles.—The Council is to purchase three electric dust-carts, at a cost of £5,500. The estimated yearly saving on dust collection by the use of these vehicles will amount to £1,400.

Sunderland.—Year's Working.—The report on the working of the Corporation tramways for 1918 shows that the receipts were £118,029, compared with £97,877. Total number of passengers carried was 26,251,700. The balance on the year's working was £51,038, of which £5,000 is given in relief of rates, making a total provided by the tramways for this purpose of £72,027. The reserve, renewals, and compensation fund amounts to £68,351. The total borrowing powers amount to £308,699, of which £5,488 is still unexhausted. Wages for 218 car hands last year came to £22,001.

Track Renewal.—Work on the tramway lines is held up through the lack of rails. Recently 200 tons of rails were ordered from Messrs. Bolchow, Vaughan & Co., of Middlesbrough, but there is no prospect of delivery.

United States.—Strike.—The Chicago tramway employés' strike, which considerably complicated the situation created by the race riots, was ended on August 2nd by the decision of the employés to accept the offer of 65 cents per hour.

Walsall.—Year's Working.—The income of the tramways undertaking for the past year amounted to £66,924, an increase of £13,235. The total expenses were £45,921, leaving a gross profit of £21,003. After payment of sinking fund charges, interest, income-tax, and allowances, there was a net profit of £8,450, against £11,496 for the previous year.

Walthamstow.—Second-hand Cars.—The Council is buying second-hand tramcars from Leeds Corporation at a cost of about £1,000 each.

York.—Extensions.—Application is to be made to the B. of T. for sanction to spend a further £17,000 on the purchase of tramcars and on work incidental to the extension of the tramway system. The Sheriff opposed the proposal, and protested against any more money being spent on trailer cars, or on triangles for turning those cars. He held they had proved a failure, and it would be cheaper to scrap the trailers and buy new cars to run under their own power.

TELEGRAPH AND TELEPHONE NOTES.

A Human Multiplex.—A Brazilian newspaper has three telephone sets attached to one telephone at each end of the line, and three simultaneous conversations are carried on at the same time over this one wire. One pair of users talks English, one pair French, and one pair Portuguese, and the listeners seem to find no difficulty in selecting the sounds intelligible to them and ignoring the others. —*T. and T. Age.*

British and U.S. Telephones.—In a recent reply in the House of Commons, Mr. Pike Pease said :—"In 1918 the number of telephones per 1,000 inhabitants in the United States was approximately 130, and in the United Kingdom 19. Development was arrested in this country by the war, whereas in the United States it proceeded very rapidly up to 1917, when that country entered the war.

"In 1918-19 about 15,911 effective local calls were made per 1,000 inhabitants in the United Kingdom, or about 16 calls per head. In addition, one trunk call per head was made during the same period. It is difficult to make any comparison with the number of calls in the United States owing to differences in the methods of calculating calls in the two countries, but the number per 1,000 inhabitants was undoubtedly much greater in the United States.

"A comparison between the cost of calls in the United Kingdom and the United States is difficult owing to differences in statistical methods. I understand that in the United States many companies reckon each call originated as two, because two conversations or two exchange connections and two subscribers are concerned with each call."

Copenhagen Telephones.—According to the *Financier*, the Copenhagen Telephone Co. is extending its operations and system, and is increasing its capital from 32,000,000 kroner to 50,000,000 kroner.

Germany.—The German censorship on ordinary letters and telegrams to foreign addresses has, says the *Times*, been abolished.

The Berlin telegraph employés on strike have signed a declaration agreeing not to take part in future in political strikes, and only to strike for economic demands after giving proper notice.

Japan.—It is stated that there is a project on foot at Tokio to link up Japan with the United States by another cable. A number of Japanese business men have the project in hand, and it is stated that a capital of some $25,000,000 will be needed for it, plus a possible subsidy from the Japanese Government.

Motorists' Telephone Service.—All the roadside telephone boxes provided by the Automobile Association are being adapted for use by members at any hour of the day or night. In addition, new sentry boxes—complete with the 24-hour telephone installation—are being erected in districts where telephones are scarce, and on roads passing through lonely areas.—*The Times.*

P.O. Wireless Service.—With reference to our note last week concerning the England-Egypt service, the P.M.G. on July 31st obtained a vote of £170,000 from the House of Commons, which will be used for starting an Imperial wireless service for commercial service. It is stated that the new service will be open for public use before the end of the year, and that negotiations with the Dominion Governments concerned are proceeding regarding the extension of the England-Egypt service to West and South Africa, India, and Australia on the one side, and to Canada on the other. P.O. engineers are installing a system which they say is free of all existing Marconi patents, and no royalties will be payable to the Marconi Co.

United States.—Mr. Daniels, Secretary of the Navy, has asked the President of the Senate and the Speaker of the House of Representatives for the immediate passing of legislation making wireless telegraphy, whether between ship and shore, trans-ocean or international, a Government monopoly. His opinion is that proper wireless communication is vital to the commercial development of the country.

By a recent decision of the Appellate Division of the Supreme Court of New York, cable companies may be taxed for the use of the land upon which their submarine cable lines are laid up to the 3-mile limit off shore. For the State of New York and the City of New York, it is said this decision will mean the assessing of additional taxes upon the cable companies of one million dollars per year.

On and after September 1st, 1919, the cable rates between San Francisco and Manila will be reduced by the Commercial Pacific Cable Co. from $1 per word to 80 cents per word. The company will also make reductions of approximately 20 per cent. in the rates to China and Japan, effective the same date. The new rates to Japan and China will be announced as soon as the Commercial Pacific Cable Co. is able to ascertain what reductions these foreign Governments will make in their terminal charges.—*T. and T. Age.*

The Postmaster-General ordered the U.S.A. telegraph and telephone systems to be returned to their private owners at midnight on Thursday, July 31st.

Plans have been announced of the laying of a new cable between the United States and Brazil, and thence down the east coast of South America. The necessary arrangements have been completed by the Western Union Telegraph Co. and the Western Telegraph Co. of Great Britain, says the *T. and T. Age.* Laying of 3,200 miles of new cable, which may be accomplished within six months, will connect Miami, Fla., with Belem, Brazil, by way of Barbados, the termini of the new system meeting the Western Union landlines at Miami and the coastal cables of the British company extending from Belem to Rio Janeiro, Buenos Ayres, and the principal cities of South America's eastern seaboard.

Although the contract between the Western Union and the Western Telegraph Co. for mutual operation of the new service has not yet been signed, the president of the Western Union Co. states that he believes it will be in the near future. The Western Union, he added, already had an option on materials required for its part of the constructional undertaking, from Miami to Barbados, the British concern having arranged to extend its South American lines from Belem to Barbados. Mr. Carlton said it had been decided to route the Western Union link in the inter-Continental cable direct from Florida to Barbados instead of utilising the present line to Cuba in order to provide service without delay between the two Americas. Construction of the Miami-Belem line will be about evenly divided between the American and the British companies, each taking practically 1,600 miles. The American lines will skirt the northern shores of Cuba and Haiti, thence following the passage between Haiti and Porto Rico and running direct to Barbados. Mr. Carlton said the Western Union was ready to proceed with construction as soon as the contract with the overseas corporation was signed.

Mr. C. H. Mackay, president of the postal-telegraph companies, has announced a reduction in rates of 20 per cent., to come into effect at midnight on July 31st.

Wireless Telephony.—General Seely, Under-Secretary for Air, is arranging an exhibition of wireless telephony for members of Parliament on Monday. A wireless telephone receiving and transmitting set will be fixed in one of the Parliamentary Committee rooms, another at the Air Ministry, and an airship and one or more aeroplanes similarly equipped will fly over London, with which members will be invited to converse.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—August 27th. N.S.W. Railways and Tramways Department. Three-phase induction motors. Chief Electrical Engineer, 61, Hunter Street, Sydney.—*Tenders.*

September 10th. N.S.W. Railways and Tramways Department. D.C. motors. Chief Electrical Engineer, 61, Hunter Street, Sydney.

Melbourne.—August 27th. Secretary for Railways. Electric capstan for Newport power house (contract No. 32,381). Local representation.*

Victoria.—August 19th. P.M.G.'s Department. Supply of detectors. (July 18th.)

Bradford.—August 15th. Corporation Electricity Department. Three water-tube boilers, superheaters, stokers, &c., natural draught chimney-type cooling tower. (July 25th.)

Eccles.—August 25th. Electricity Department. Three 500-K.V.A., 3-phase, A.C. transformers. (See this issue.)

Edinburgh.—September 11th. T.C. Three 10,000-KW. turbo-alternators; six water-tube boilers, capacity 65,000 lb. per hour. (See this issue.)

Grimsby.—August 11th. Electricity Department. Piping, electrically-driven pump, and tank. (July 18th.)

Halifax.—Tramways Committee. Overhead equipment required for the running of trackless cars to Mount Tabor and Wainstalls. Also additional motor 'buses.

Lincoln.—September 2nd. Corporation. One 25-ton overhead electric crane. (See this issue.)

Redditch.—August 10th. U.D.C. A lightning conductor at the electricity works. G. W. Hobson, Clerk to the Council.

Torquay.—B.C. Electricity Department. Second-hand Lancashire boiler or other suitable oil-fuel tank. (August 1st.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Bradford.—Tramways Committee :—

Manganese steel crossings, £253; perforated steel cylinders, £37.—Hadfields, Ltd.
Special point tongues, £72.—Colliers Bros.
10 tons of copper trolley wire, £1,572.—Colliers Bros.

Electricity Committee :—

Three electric capstans for Valley Road coal-siding.—Royce, Ltd.

Glasgow.—T.C. Tramways Department :—

Single-way stoneware ducts.—Doultons.
3/20 V.I.R. cable.—G.E. Co., Ltd.

The T.C. has also accepted the following tenders :—

Six 2-ton electric vehicles, £1,804 each.—Edison Accumulators, Ltd.
Two electric vehicles, £1,110 each.—Electric Vehicles, Ltd.

New Zealand.—Dunedin.—City Council. One synchronous motor, £4,070. British Westinghouse Co. According to the *Times* there was an American tender of £800 less with delivery four months earlier.

Sunderland.—Tramways Committee :—

Six vestibule, covered-in, double-deck car bodies, with delivery at the beginning of next year.—English Electric Co., Ltd.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 9th. At the Wood Memorial Hall, Newcastle-on-Tyne. Annual general meeting.

Industrial League.—Tuesday, August 12th and two following days. At the Midland Institute, Birmingham. Special summer convention. Presidential address by Mr. G. H. Roberts, M.P. The following topics will be discussed : "Finance in its Relations to Labour and Industry," "Labour in its Relation to Industry," and "Education in its Relations to Labour and Industry."

NOTES.

Industrial Essay Competition.—Two hundred pounds are offered in prizes (£100 down to £5) by *Unity*, the organ of the National Alliance of Employers and Employed for the best essay on either of the following subjects :—A practical scheme for the joint development of industry by capital and labour; the most effective means for the prevention of unemployment : the most effective means for the prevention of industrial disputes. The above sum has been presented by Sir Robert Hadfield, and the Committee of Award consists of the Hon. F. Huth Jackson, P.C., the Master of Balliol College, Oxford, and the Right Hon. Arthur Henderson, P.C. The offices of *Unity* are at 64, Victoria Street, S.W. 1. Essays must not exceed 3,000 words in length, and must be received by August 30th.

British Scientific Products Exhibition.—Interesting and important demonstrations were given at the Exhibition, Central Hall, Westminster, on Friday last. Dr. Fournier d'Albe demonstrated audible light, which is a development of the principle of the optophone, an instrument for enabling blind people to read ordinary print. Major H. W. Buddicom showed a selenium apparatus which automatically controls the course of a vessel. Any deviation from this course is indicated by the lighting of a green or red lamp and by ringing a warning bell. The Exhibition closed on Tuesday last.

Wages Conference of Local Authorities, Greater London.—The first report in connection with the Wages Conference of Local Authorities states that the Conference was brought into being through the representations of the Chief Industrial Commissioner, Sir George Askwith, who met, in September, 1917, representatives of the employers and of the Unions, the outcome of which meeting was the formation of the Conference for the purpose of endeavouring amicably to settle points of difference existing, and likely to arise, on the question of salaries, wages, and hours of employment of all employés engaged in the municipal electricity undertakings of Greater London. Nine Councillor members and nine borough electrical engineers were elected to form an Executive Committee, the representatives being chosen from 18 boroughs.

At the first meeting of the Executive Committee it was unanimously agreed that the work before the members would require tactful handling, and all questions would have to be met in a fair and reasonable spirit, void of bias, if satisfactory conclusions were to be arrived at ; the Committee adhered to the course agreed to, and the position of the Conference at the present time in regard to the employés stands at a very high level ; at no time were negotiations broken off on account of disagreement, except just prior to the arbitration proceedings, the outcome of which was Award 2,772.

The Executive Committee primarily drafted all the conditions and terms under which Award 2,772 was settled, although at the final settlement (in order to secure that this Award should apply throughout London) the Unions concerned cited the London companies and other authorities.

Subsequently, by representation the Executive formed part of the combination which was set up under Clause 13 of Award 2,772 to deal with matters of dispute, and was a party to the settlement of the 47/48-hour week, and on February 18th represented the London boroughs in the arbitration proceedings on the claim of the Electrical Power Engineers' Association for a considerable advance.

The Committee has presented a claim on behalf of the Conference for representation on the Industrial Council. The chairman of the Executive Committee is Mr. Alderman J. A. G. Beaumont, and the hon. secretary is Mr. Arthur J. Fuller, Electricity Works, Townmead Road, Fulham, S.W. 6.

Domestic E.L. Plant.—With reference to Messrs. Arthur Lyon & Wrench's exhibit at the British Scientific Products Exhibition, on page 136 of our last issue, the 0·5 to 1-kw. domestic electric lighting set was by error described as the "Polar" type. This should read "Popular" type, under which name these sets are advertised and sold.

The Strike Penalty at Petrograd.—Interrupting a tramway strikers' meeting in Petrograd, Bolshevists arrested those taking part in it and executed the chairman and a few others in the presence of the rest.—*The Times.*

Young Engineers' Opportunity.—Vice-Admiral Sir Gordon Wilson Moore, speaking at the certificate day of the Crystal Palace School of Practical Engineering, said they stood on the threshold of a new world, organised, or about to be organised, upon a totally different footing scientifically and commercially.

In this organisation the engineering profession must think itself supreme, carrying with its science the vital spark to energise the great commercial world. Their work was to create and operate the network of commercial production and distribution. The hope of every civilised country was in increased production, an increase over pre-war times. Herein lay the engineers' chance for every little improvement helped labour in production.

Young engineers starting on their profession had a golden opportunity before them such as was seldom offered to any profession.—*The Times.*

Wireless Telegraphy.—A sum of 40,000 fr. (£1,600) has been allotted by the International Research Board to the International Union of Scientific Radiotelegraphy.

The Training of Demobilised Officers.—Brigadier-General A. A. Asquith, Controller of the Appointments Department, is reported in the Press as stating last week that there was considerable difficulty in administering the Government scheme of training. Four years' recruits to the professions, all had to be absorbed in a year or more. The only way they could be absorbed would be for professional men to take a certain number of ex-officers and men and attach them to their works and teach them their trades. This would mean their taking into their businesses many more men than they needed, and inconveniencing themselves in so doing. About 18,000 ex-officers and men had applied for training, with State assistance. So far 2,000 trainings have been granted, but the position of the balance of 16,000 was a grave one. They had had 1,200 to 1,300 offers from employers to take men, but unless a great number of other vacancies were forthcoming it was very difficult to see how the schemes could be carried through. He hoped that the professional societies could waive their premiums and accept in lieu a man's war service.

The Electricity Supply Bill.—On Wednesday, last week, the debate on the price to be paid for a generating station was resumed in Standing Committee "B" ; an amendment had been proposed by Commander Dawes providing that the price should be the actual cost of the station and site, less depreciation, and the question whether municipalities and companies should be treated alike was considered. Mr. Bridgeman, Parliamentary Secretary to the Board of Trade, said the Government could not accept the view that all should receive the same terms ; companies which had invested capital and undertaken public duties, with the promise of stated terms of purchase, were in a different position from local authorities. The amendment was rejected, but the Government accepted an amendment that the local authority should have the option to be paid a sum determined, if necessary, by an arbitrator appointed by the Board of Trade, instead of payment by annuity. It was agreed that where a substantial part of the cost of a local authority's undertaking had been defrayed otherwise than by loans, the annuities might be increased by such amount as the Electricity Commissioners thought just.

On the question of payment for stations and lines belonging to companies, Mr. G. Balfour proposed that compensation should be given for the unexpired period that might elapse before the right of purchase by local authorities matured. The Home Secretary said that the Government had put down amendments to meet the case. It was proposed to eliminate all questions of depreciation, by way of compensation for the loss of the unexpired period. The amendment was rejected, and the Committee adjourned.

On the following day Mr. Marriott moved an amendment to the effect that, failing agreement, the price should be determined by arbitration, no allowance being made for compulsory sale or for appreciation or depreciation of value ; the price not to be less than would be payable by the local authority. The amendment was rejected, and the Committee adjourned until Tuesday last.

Electricians' Strike Plans.—According to the daily Press, the Government was forewarned that one of the schemes which was to follow the police strike was a strike of London electricians designed to cut off the supply of electricity, and to stop the tramways and underground railways. The Act of Parliament of 1875, which makes a strike without notice in water works and gas works a crime punishable by imprisonment, has been extended to electricity works. Notices to that effect have been posted by the Government in all such works, and men's leaders warned that their immediate arrest will follow a sudden strike. If in spite of this a strike takes place, the Government will run the generating stations and maintain the supply of electricity.

Mr. Wyatt, assistant secretary of the Electrical Trades Union, stated that no movement of this kind was contemplated by the Union.

Oil in Norfolk.—It is reported that liquid oil has been found on the shale properties of English Oilfields, Ltd., in Norfolk.

The discovery of ozokerite, which was recently reported at Stow Bridge, has been confirmed.

Control of Water Power.—Sir Auckland Geddes says that he is considering the question of introducing legislation of an interim character providing for the control of water-power developments. The Aluminium Corporation has applied to the Board of Trade for an Order under the Special Acts (Extension of Time) Act, 1915, to extend for one year the period of three years fixed by the Conway and Colwyn Bay Joint Water Supply Board Act, 1916, for the completion of the dam of Lake Cowlyd. Notice of this application has been advertised, and objections to it were to be sent to the Board of Trade on before August 2nd.

Institution and Lecture Notes.—The new power station which the Corporation of Rotherham are erecting was, on July 26th, visited by a party of members of the Yorkshire Branch of the Association of Mining Electrical Engineers. A very interesting afternoon was spent under the conductorship of Messrs. J. W. Treherne and Harrison, and a hearty vote of thanks was accorded to Mr. E. Cross (engineer and general manager) and the conductors, on the motion of Mr. W. Winter (branch secretary), seconded by Mr. A. L. Flint.

Institute of Metals.—The autumn meeting will be held at Sheffield, on September 24th and 25th, and will be marked by visits to several famous works, as well as a motor excursion through the Peak District. Amongst the papers to be read is one on the early history of electro-silver plating; moulding sands for non-ferrous foundry work, bearing metal, and the season cracking of brass are the subjects of other communications. Applicants for membership whose forms are received by the secretary, Mr. G. Shaw Scott, 36, Victoria Street, S.W. 1, by September 10th, will be entitled to share in the proceedings.

Birmingham Housing Exhibition.—A very big Housing Exhibition was held in the Birmingham Town Hall last month. It was opened by the Lady Mayoress on July 9th, and remained open until July 19th. An electrical stand was arranged by the City of Birmingham Electric Supply Department, at which 10 firms of electrical manufacturers displayed an up-to-date selection of lighting fittings, shades, radiators, ovens, cooking utensils

Electrical Stand at Birmingham Exhibition.

vacuum cleaners, boot and knife cleaners, and other modern domestic appliances. The Exhibition was a great success, and was visited by many hundreds of people interested in the provision of houses in Birmingham and the Midlands. The greatest

Electrical Stand at Birmingham Exhibition.

possible interest was taken in the electrical stand, which will no doubt still further stimulate the development of electricity in its household applications.

The names of the firms exhibiting were:—The Berry Electric, Ltd.; the British Thomson-Houston Co., Ltd.; Credenda Conduits, Ltd.; Premier Electric Heaters, Ltd.; General Electric Co., Ltd.; Edison & Swan, Ltd.; St. Helens Cable & Rubber Co., Ltd.; Benham & Sons, Ltd.; Daisy Vacuum Cleaner Co., Ltd.; the British Westinghouse Electric and Manufacturing Co., Ltd.

We reproduce above two views of the electrical stand, for which we are indebted to Mr. E. J. Jennings, secretary to the Birmingham Electricity Supply Department.

Appointments Vacant.—General manager of electricity, tramways, and motor-'bus undertakings (£600) for the Chesterfield Corporation; shift engineer (82s. 6d.), switchboard attendant (66s.) for the Redditch U.D.C. electricity works; chief clerk (£350) for the Sunderland Corporation electricity department. See our advertisement pages to-day.

Employment of Ex-Service Men.—According to the *Daily Mail*, Mr. H. Mensforth, general manager of the British Westinghouse works at Manchester, has a letter from a local branch of the Society of Ironfounders demanding the withdrawal of returned soldiers taken into the foundry to become moulders.

London's Refuse and its Disposal.—It is proposed to revive a conference of representatives of the City Corporation and the Metropolitan Borough Councils, set up in 1914, to discuss the question of disposing of London's refuse.—*The Times.*

Oxygen and Hydrogen by Electrolysis.—With reference to the article in our last issue on the above subject, we are informed that the Integral Oxygen Co., Ltd. (I.O.C.), 38, Victoria Street, Westminster, S.W. 1, has acquired the British and Colonial rights from the American company, together with other patents and improvements. New works are being started to manufacture the cells described entirely in this country.

Electric Omnibus-boats.—A scheme has been laid before the London County Council by Captain W. P. Durtnall, contemplating the placing of a service of "Paragon" electrical omnibus-boats on the River Thames, propelled by his "beater" propeller.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—We shall be glad to hear from, or to receive the address of, Mr. Rupert Ernest Cunningham, who resigned from the post of mains superintendent under the Calcutta Electric Supply Corporation, Ltd., several months ago.

When Bermondsey Town Council had before it last week a recommendation to increase pre-war salaries of the staff from the Town Clerk down to the Chief Librarian, a number of councillors left the room as a protest, but as they had not all left the Mayor declared the increases carried. There was not a quorum, however, when the resolution for drawing the necessary cheques was put, and according to the *Daily Chronicle* the proceedings ended in fiasco. One of the awards was for £185 extra to the electrical engineer on a salary of £625.

Todmorden T.C. has retained Mr. Boyce, the late borough electrical engineer and now engineer to the Morecambe Corporation, in an advisory capacity, at a fee of £100 per annum, with out-of-pocket expenses.

Peterborough T.C. has increased the salary of the electrical engineer from £330 to £450 a year.

Canterbury T.C. has increased the salary of the electrical engineer, Mr. Blascheck, by £99 a year to £566.

On Thursday last week, at a smoking concert, Mr. J. W. Beauchamp, director of the Electrical Development Association, and late chief engineer of West Ham Corporation Electricity Works, was presented with a handsome tantalus to which every member of the staff and employés had contributed. Mr. F. W. Purse, in making the presentation, referred to Mr. Beauchamp's seven years' work, and to the difficulties with which he had had to contend during the war years. Mr. Beauchamp, in acknowledging the gift, laid stress on the importance of co-operative effort in the strenuous future.

On August 1st a smoking concert was held at "Ye Olde Packe Horse," at which the presentation of a barometer and set of ebony hair brushes was made by Mr. T. R. Smith, the city electrical engineer and manager, on behalf of the staff and employés of the Leicester Corporation Tramways and Electricity Department, to Mr. D. Barry, shift engineer at the Lero Power Station, who is leaving to take up a similar position under the Manchester Corporation.

Mr. J. Williams, at present engaged with the Yorkshire Electric Power Co. as testing assistant, has been appointed technical assistant to the borough electrical engineer at Salford.

Mr. C. E. Howarth has resigned his position as assistant engineer and draughtsman with the Yorkshire Electric Power Co. to take an appointment with Messrs. Hopkinson & Co., Huddersfield, as leading draughtsman.

Mr. C. W. Bostock, who for the last seven years has been charge engineer with the Yorkshire Electric Power Co., has resigned his position there, and has been appointed shift engineer with the Liverpool Corporation.

Mr. E. B. Pausey, assistant resident engineer, Bury Electricity Works, has been appointed station superintendent at the Loughborough Electricity Works.

General.—Lieutenant and Acting Captain L. R. W. A. Shuter, Kent Fortress Engineers (Electric Lights Company), has relinquished his acting rank on ceasing to be employed.

Captain and Brevet-Major S. E. Monkhouse, A.M.I.E.E., Tyne Electrical Engineers, has been restored to the establishment of the corps. Major Monkhouse was commissioned in the Tyne Electrical Engineers (Territorial Force) in December, 1913, was promoted captain in June, 1916, and got his brevet step of major in June of last year. He was seconded whilst an instructor at the School of Instruction, where he held the rank of lieutenant-colonel, and received the rank of brevet-major in recognition of his valuable services in the war.

Capt. (Acting Major) E. T. Caparn, M.C., R.E., A.M.I.E.E., has been appointed, on demobilisation, to the post of electrical manager in Messrs. Scott & Co.'s shipbuilding and engineering works, Greenock, vice Mr. A. Henderson, M.I.E.E., resigned.

Obituary.—Mr. H. H. P. Powles.—We regret to record that Mr. Henry Handley Pridham Powles passed away on July 27th, aged 72, at a nursing home in London, after a few months' illness. Mr. Powles was apprenticed in 1864 to Messrs. E. R. & F. Turner, of Ipswich, and in 1869 he went as improver and engine fitter to Messrs. Ransomes, Sims & Head, Ipswich. In 1871 he returned to Messrs. Turner's works and was employed in the drawing office and on works in various parts of the country. He became their head draughtsman in 1876, and remained at the works in that capacity until 1890, when he came to London to act as mechanical engineer to the Electrical Standardising and Training Institution, Faraday House, which had just started in temporary premises in Adam Street, Adelphi. He arranged and fitted up the workshops at the new premises in Charing Cross Road, and remained with the Institution until January, 1898, when he joined Sir Alexander Kennedy's technical staff as assistant, and was put in charge of the drawing office. Mr. Powles remained as an assistant to Sir Alexander Kennedy until January, 1912, and had been until his death retained by Messrs. Kennedy & Donkin for research work and inspections. During 1916 and 1917 he was employed in inspecting constructional work and plant for one of the munition factories. In 1917 and 1918 he did useful work on preparing a bibliography of all works connected with the subject of lubricants and lubrication for the Scientific and Industrial Research Department. He was known by a large body of engineers, especially electrical engineers, who passed through Faraday House when he was there as mechanical engineer. His work for Sir Alexander Kennedy was very highly valued. He was an Assoc. Mem. Inst. C.E. & M.I. Mech. E. He translated H. Haeder's book on the steam engine. During the last seven or eight years Mr. Powles was responsible for the revision and enlargement for Messrs. Crosby Lockwood of D. K. Clarke's "Mechanical Engineer's Pocket Book." In 1905 he prepared a work on the "History and Development of Steam Boilers," which was published by Messrs. Constable & Co.

NEW COMPANIES REGISTERED.

E.P.I., Ltd. (157,526).—Private company. Registered July 30th. Capital, £10,000 in £1 shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, electrical engineers and contractors, carriers of passengers and goods, manufacturers of and dealers in railway, tramway electric, magnetic, galvanic and other apparatus. The subscribers (each with one share) are: H. McIntyre, 9, Albert Buildings, Preesons Row, Liverpool, engineer; R. B. Stephenson, 34, Castle Street, Liverpool, solicitor. The first directors are not named. Secretary: H. Dewhurst. Solicitor: R. B. Stephenson, 34, Castle Street, Liverpool.

Leighton Buzzard Light Railway, Ltd. (157,426).—Private company. Registered July 26th. Capital, £20,000 in £1 shares. To construct light railways and tramways in the counties of Bedford and Buckingham and the adjoining counties. The subscribers (each with one share) are: G. Garside, White House, Hockliffe Street, Leighton Buzzard, sand merchant; R. G. Walton, 20, Bridge Street, Leighton Buzzard, Beds, solicitor. Directors: A. J. J. Arnold, "Sandy Mount," Heath Road, Leighton Buzzard, Beds; E. F. Arnold, "Haslemere," Rothschild Road, Linslade, Bucks; G. Garside, R. G. Walton, H. F. Delafield, Hartwell Crescent, Leighton Buzzard; and T. B. Bassett, "The Hatch," Heath, Leighton Buzzard. Registered office: 20, Bridge Street, Leighton Buzzard.

Commercial Electrical Accessories, Ltd. (157,476).—Private company. Registered July 29th. Capital, £20,000 in £1 shares (5,000 7 per cent. cumulative part preference). To acquire the wholesale and export electrical supply business carried on by Tredegar, Ltd. The subscribers (each with one share) are: N. A. Bartlett, 56, Victoria Street, Westminster, S.W., contractor; A. W. G. Bedbrook, 9, Decina Place, Euston Road, N.W., engineer. The first directors are: H. G. Bartlett and A. W. J. Bedbrook. Solicitors: Munns and Longden, 4b, Fredericks Place, Old Jewry, E.C.

Northern Electrical Manufacturing Co., Ltd. (157,494).—Private company. Registered July 29th. Capital, £3,000 in £1 shares (1,000 7 per cent. cumulative preference). Manufacturers of and dealers in electrical switch gear, electrical accessories, switchboards, magnetos, signalling apparatus, bells, batteries, accumulators, motors, dynamos, &c. The subscribers (each with one share) are: S. Dobson, 17, Oak Lane, Bradford, electrical engineer; W. Dobson, 40, Church Street, Bradford, electrical engineer. Directors: S. Dobson, W. Dobson, J. Dobson, 17, Oak Lane, Bradford, and T. Barnes, 29, Norwood Road, Shipley. Registered office: Back Church Street, Bradford.

Unelma, Ltd. (157,507).—Private company. Registered July 29th. Capital, £9,000 in £1 shares. Objects: To take over the business of a manufacturer of electrical batteries, dry cells for bells and telephones, pocket lamp cases, petrol and tinder lighters, electrical novelties, &c., carried on by B. Pordes as the "United Electrical Manufacturers Co." at Unelma House, 18, 20 and 22, Christopher Street, Finsbury, E.C. The Board of Trade has licensed the acquisition by the company of the above business, the books and documents of which have been liable to inspection under Section 2 (2) of the Trading with the Enemy Act. The first directors are B. Pordes (permanent) and M. Pordes. Qualification, £25. Solicitor: W. Weiss, 36-7, Queen Street, E.C. Registered office: 18, 20 and 22, Christopher Street, E.C.

Pollock & Macnab (1919), Ltd. (157,587).—Registered July 31st. Capital, £150,000 in £1 shares (100,000 cumulative preference). Objects: To take over the business of Pollock & Macnab, Ltd., engineers and machine tool makers, of Bredbury, Cheshire. The subscribers (each with one share) are: J. Macnab, Westlands, Marple, engineer; S. Macnab, Meadowcroft, Marple, engineer; Mrs. J. Leigh, Croftside, Marple; F. S. Stancliffe, 13, Spring Gardens, Manchester, solicitor; T. F. Grundy, 40, Brazennose Street, Manchester, incorporated accountant; W. F. Hughes, 2, Elmswood Avenue, Moss Side, Manchester, solicitor's clerk; R. H. Smithson, 14, Lever Place, Hulme, Manchester, solicitor's clerk. The first directors are J. Macnab and S. Macnab and any others to be appointed by the subscribers. Solicitor: H. Whitcombe, 13, Spring Gardens, Manchester. Registered office: Britannia Machine Tool Works, Bredbury, near Stockport, Cheshire.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. A. & R. J. Jacobs, Ltd.—Mortgage on lands in Edgware Road, registered June 19th, 1919, to secure £4,000. Holders: A. J. Winter, 9-15, Whitecross Street, E.C., and others, trading as M. & D. Wolff.

Motive Power Improvement Co., Ltd.—Issue registered July 7th, 1919, of 100 debentures, part of a series of £1,000 already registered.

Siemens Brothers & Co., Ltd.—Satisfaction registered July 9th, 1919, of £1,625, part of amount outstanding on July 1st, 1908, and registered under Section 12 of the 1907 Act.

Brompton & Kensington Electricity Supply Co., Ltd. (25,913).—Return dated April 10th, 1919. Capital, £300,000 in 20,000 preference and 40,000 ordinary shares of £5 each. 5,876 preference and 34,124 ordinary shares taken up. £195,000 paid on 5,876 preference and 33,124 ordinary. £5,000 considered as paid on 1,000 ordinary shares. Mortgages and charges, nil.

Brook, Hirst & Co., Ltd. (95,264).—Return dated January 14th, 1919. Capital, £20,000 in £1 shares. 12,500 shares taken up. £12,500 considered as paid. Mortgages and charges, £7,000.

Brush Electrical Engineering Co., Ltd. (29,533).—Return dated June 2nd, 1919. Capital, £253,780 in 148,536 ordinary shares of £1 each and £105,244 ordinary stock. All the ordinary stock has been taken up. £49,312 16s. paid. £55,931 4s. considered as paid. Mortgages and charges, £344,763 18s.

CITY NOTES.

Yorkshire Electric Power Co.

The directors report that the June half-year has been one of great difficulty to all industries including those dependent on the company for a supply of electricity; the sudden cessation of munition work caused an immediate reduction of output, and the difficulties of resuming normal peace-time activities have been increased by the uncertainty as to taxation and Government policy. The revenue has been greater than that for the corresponding period in 1918, and contracts have been made which will substantially increase the company's output in the near future. The cost of coal, labour and material has continued to increase, the net profit for the half-year compared with that for the same period in the two previous years being: 1917, £17,617; 1918, £23,683; 1919, £19,230. The dividend for the half-year on the 6 per cent. cumulative preference capital has been paid.

The Electricity (Supply) Bill now before Parliament proposes to make important alterations in the control and organisation of electricity supply undertakings. Bodies representative of these undertakings and of large users of electric power have approached the Government with recommendations for amendments of the Bill which it is hoped may be accepted. It is generally felt that the appointment of Electricity Commissioners as proposed will be beneficial to the industry but that the formation of District Boards would result in an unnecessary increase in the cost of supplying electric power.

In February an allotment at par of £60,400 of ordinary shares was made. The whole issue has been taken up. Many demands are being made upon the company for supplies of current, and further capital must be issued to meet the cost of the necessary extensions. Proposals as to the provision of this capital will be brought forward in due course.

Direct United States Cable Co., Ltd.

The report just issued contains the accounts for the year ended March, 1919, the preparation of which was deferred until the cost to the company of the unsuccessful expedition of the C.S. *Faraday* to repair the main cable in 1918 had been ascertained. The accounts include the whole of the expenses in connection therewith. Last April the shareholders were informed that in consequence of the repair of the main cable not having been completed by September 22nd, 1918, the Western Union Telegraph Co. had applied the penal clause of the lease and only paid half the rental for the six months to March 22nd, 1919. Since the latter date no rent had been received from the Western Union Telegraph Co. and that company had served a notice upon their directors purporting to determine the lease as from March 22nd, 1919. It was not possible for the main cable to be repaired during 1917, owing to the fact that there was no vessel available and that during the war the Admiralty took control of all cable ships and their allocation for repairs of cables, determining the order in which such repairs should be executed. Notwithstanding the representations made by the directors that they had first claim upon the services of the C.S. *Faraday* in the spring of 1918, the Admiralty acceded to the request of the Western Union Telegraph Co. that the *Faraday* should effect the repair of one of the cables operated by that company before proceeding upon the work of repairing the main cable of this company, and as a result it was not possible to effect the restoration of the latter during the year 1918. The directors have taken the best legal opinion obtainable and have applied to the High Courts of Justice under the Courts Emergency Powers Act, for relief from the application of the penal clause of the lease (which provides for a reduction of rent and the termination of the lease in the event of the cable not being repaired within 18 months of the date of the interruption). The application seeking this relief is now before the Courts and the directors are doing all that is possible to expedite the hearing thereof. In consequence of the action of the Western Union Telegraph Co. in stopping payment of the rent, the directors were unable to pay the final dividend for

the quarter to March 31st, 1919. If the application for relief referred to is successful the payment of a final dividend for the year ended March 31st, 1919, will receive consideration. In addition to paying a fixed rent for the use of the company's cable, the lease provides that the Western Union Telegraph Co. should make a contribution towards directors' fees and should further pay the administration expenses of the company. Up to March 31st, 1919, the Western Union Telegraph Co. had withheld £469 in respect of their contribution towards the directors' fees and £886 in respect of administration expenses. These items form part of the company's claim against the Western Union Telegraph Co. The cost of maintaining the cables during the year has amounted to £89,171. Of this sum £77,028 represents expenditure in which the company was involved in the abortive effort to repair the main cable in 1918. The main cable was successfully repaired on June 28th, and is now being operated by the Western Union Telegraph Co. The cost of that repair has not yet been ascertained and is not included in the accounts.

British Thomson-Houston Co., Ltd.

The directors' report for the year 1918 states, in respect of the works at Rugby, Coventry and Willesden, that the buildings and machinery have been maintained in good condition. On account of pressure of work and other physical difficulties it was not possible to take inventories, excepting in the lamp factory and at the various branch offices (these being taken in the usual way) so that in making up the accounts for the year book figures were taken. A similar course was adopted at the end of 1914 and again at the end of 1916, and the figures were fully justified when complete inventories were taken in December, 1915 and 1917, respectively. There is every reason to believe that the same will be the case in the present instance. The profits for the year, after deducting all expenses and charges other than interest on debentures and loans, and after making provision for estimated war taxation for the year, were £317,016 *plus* the amount brought forward (£53,744) and adding adjustment of munitions levy and excess profits duty to end of 1916 (£11,841), making £382,600. From this is deducted interest on debentures and loans, £107,946. There is to be appropriated for depreciations and reserve £123,791, leaving to carry forward £150,863. The capital reserve account has been increased from £237,959 to £245,555. The value of the shares and debentures of lighting, traction and other companies has been decreased partly by sales and partly by further depreciations, from £90,000 to £60,000. This valuation is very conservative. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts and other contingencies. The directors are considering the question of new capital required by the constant growth of the company's business, and proposals dealing with this matter will be presented to the shareholders in due course. 1,761 employés of the company joined his Majesty's Forces. 241 fell; 252 were wounded; 189 received commissions, 85 were awarded special honours; 27 were mentioned in despatches; 12 were specially commended for services in the field. During the entire period of the war the company made liberal grants to dependants of the employés so serving.

The annual meeting was held at 83, Cannon Street, E.C., on July 30th. Mr. H. C. Levis, chairman and managing director, first referred to the services of the men who joined the Forces. Referring to the report, he said that the directors, after consultation with the holders of a large majority of the shares of the company, both ordinary and preferred, did not recommend the payment of dividends at this time. They were considering the question of new capital required by the constant growth of the business, and proposals relative to that would later on be laid before the shareholders for consideration. In his remarks respecting the balance sheet the speaker said that the works were carried at a very conservative figure, having in mind their cost—and particularly conservative, having in mind present values. Last year he intimated that it would be interesting if a statement could be made relative to the character of the work which they were carrying out for war purposes, and while it might not be desirable to publish full particulars, he might mention a number of things which would show the general character of the war work which they did, first calling attention to the fact that practically all the output of their factories was either directly for the Government or was done under the authority of Government certificates. The bulk of their output was composed of their regular products applied to war uses, but there were many things that were specially developed for war purposes. Several of the latter would, however, continue to be manufactured as part of the regular product of the company. At Rugby they made transformers, double current generators, motor alternators and other appliances for wireless work; electric dynamometers for loading and testing aeroplane engines; motors with timing gear for enabling Lewis guns to be fired between aero propeller blades. Motors were supplied for all sorts of special purposes, such as for trench pumps; for aeroplane speedometer testing; for mobile repair workshops; for operating gun lathes, &c. Then there were generating sets for searchlights; turbo fans for the Admiralty; high, intermediate and low pressure turbines for naval patrol boats; and turbines for destroyers and other ships. Munitions were manufactured on a considerable scale, including 4-in. naval high explosive shells; 4.5 high explosive shells; 4.7 proof shot and naval high explosive shells; and sixty-pounder shells. A very large number of primers, adapters, shells for howitzer bombs, smoke bombs, firing gear for trench mortars and trench howitzers; turn-tables for bomb-throwing howitzers; rollers for "tanks," mines, depth-charge cases, and a large number of other articles of that character too numerous to mention. Their works management had a great deal to do with the initiation and successful starting of the co-operative scheme of shell-making among the Leicester and district engineers, who, he understood, were probably the first body in this country to produce shells, &c., outside the regular ordnance firms. He also believed that their company was the first private concern—outside of armament firms—to produce shells after the outbreak of the war. At their lamp works, in addition to all kinds of lamps for Government factories, for the Admiralty, Ministry of Munitions, H.M. Office of Works, &c., they manufactured a large quantity of appliances for wireless telegraphy, daylight signal lamps, lamps for use on aeroplanes, &c. One of the most important things accomplished in their lamp works was the development of the manufacture of half-watt type or gas-filled lamps. Those were now being produced in large and increasing quantities. In their illuminating engineering department a large number of special things were developed, such as gas and water-tight fittings to be used in shell-filling factories, and special reflectors and lighting devices for munition and aircraft factories. One of the most important developments was the manufacture of magnetos at their Coventry works. Thousands of magnetos were supplied for aeroplanes—the whole of the Coventry works being devoted to that purpose. Marked success was achieved, and there were no more reliable or efficient magnetos manufactured than those made by them. It was of special interest to note that their magnetos were on the aeroplane which recently achieved the altitude record; they were on the aeroplanes which won first and second places in the recent Aerial Derby; and, finally, were on Airship R.34, which made the successful flight to America and back. They were able on many occasions to give technical assistance to the Government, as their engineering staff was always ready to help whenever the necessity arose. It was of interest to note that they were completing the largest turbo-generator ever built in this country (30,000 KW.) and two of the largest electric equipments for steel-rolling mills ever built anywhere. Their orders for the first half of 1919 were larger than for any similar period in the history of the company. He hesitated to say anything about the general situation, particularly the evidences of unrest which were apparent in so many directions, but looking to the past history of the country he could not help feeling that it was a passing phase, which would be settled by readjustments along reasonable lines. One thing must be fully recognised, and the sooner the better, and that was that this country must produce a larger output at reasonable cost, or we should not be able to sell in foreign markets, which would in turn further depress the foreign exchange, and ultimately land us in disaster. Judging from the inquiries which they had received since the armistice was signed, there was a large amount of business in sight, but the placing of orders largely depended on whether the general conditions throughout the country became stable in the near future. If that was accomplished, and prices were reasonable, orders would come in in an increasing volume, and would be to the benefit of all concerned. It could not be too strongly urged or too often repeated that the greatest possible effort must be put forth in every direction if we were to hold our own in the markets of the world. Mr. A. R. Monks seconded the motion, and the report was adopted without discussion.

Cordoba Light, Power & Traction Co., Ltd.—Sir George Touche, presiding at the annual meeting, stated that the improvement in the results for the past six months was at the rate of £38,000 per annum over those of the year ended September, 1917. In view of present uncertainties the directors regretted that they were unable to recommend the payment of a dividend on the preference shares. The full preference dividend for the 18 months would require £27,000. The profit for the period covered by the accounts now submitted was nearly £7,000 short of that amount, but rather more than that difference was brought forward from the previous undivided balance. In more settled conditions, and in view of the substantial improvement of the last few months, they might have made a distribution, but the future was too obscure for them to take such a risk. The war had produced a spirit of unrest and a hostility to ordered industry and settled government which might have its counterpart in South America. There was an aggressive attitude towards foreign capital. Prudent investors were noting the tendencies, and European money markets were watching events in Argentine with close attention.

Marconi Wireless Telegraph Co. of Canada.—It is stated that at the meeting of this company in Canada on September 17th a resolution will be submitted to reduce the capital from $5,000,000 to $3,750,000 by reducing the par value of the outstanding capital stock from $5 to $2½ per share, and to authorise the issue of an additional 500,000 shares of $2½ each.

Pernambuco Tramways & Power Co.—Dividend of 3½ per cent., less tax, on preference shares for half-year; £10,000 to renewal and general reserve; £1,500 to amortisation account; £10,230 to capital reserve; £605 for exchange; £13,489 forward. The *Financial Times* states that it is proposed to increase the borrowing powers by £500,000.

Stock Exchange Notices.—Application has been made to the committee to allow the following to be officially quoted:—

Barcelona Traction, Light and Power Co., Ltd.—£30,000 seven per cent. fifty-year prior lien "A" bonds, Nos. 6,505 to 6,804, of £100 each.

British Westinghouse Electric and Manufacturing Co., Ltd.—1,000,000 ordinary shares of £1 each, fully paid, Nos. 1,185,001 to 2,185,000 (special application).

Marconi International Marine Communication Co., Ltd.—592,286 additional shares of £1 each, fully paid, Nos. 600,001 to 1,192,286.

National Gas Engine Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less tax, on preference shares, and 7½ per cent. per annum, less tax, on ordinary for the June half-year.

Westminster Electric Supply Corporation, Ltd.—Interim dividend at the rate of 7 per cent. per annum, less tax, for June half-year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—Dividend at the rate of 1s. 3d. per share (5 per cent. per annum), less tax, for quarter ended June.

Bristol Tramways & Carriage Co., Ltd.—Interim dividend for the half-year ended June 30th, 1919 at the rate of 3 per cent. (free of income tax) on the ordinary shares.

Hong-Kong Tramway Co.—Interim dividend 9d. per share, less tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets continue handicapped by the same kind of troubles that have worried them for the past few weeks. Labour disturbances and foreign exchange difficulties are the two main factors militating against return of public confidence. The country is spending 4½ million pounds per diem, according to the Chancellor of the Exchequer, and as restrictions become gradually relaxed, so must the demand for money grow, and money rates increase. Industrial companies still are cramped through inability to obtain sufficiency of raw material. If reduction in the present cost of living depends, as the official advertisements of the new Loan assured us, upon the Loan being a triumphant success, the modest amount secured may be regarded as leading to maintenance of high prices, of profiteering, and big post-war profits by many industrial companies. Meanwhile, the rise in the price of coal is an adverse consideration. It may be observed that London gets its coal cheaper than Guernsey does. The price at St. Peter Port is 87s. per ton, including delivery.

Electric lighting prices are dull and heavy. The additional cost of coal is the latest straw, and shareholders apparently derive small comfort from the suggestion that the extra 6s. per ton will doubtless be passed on to consumers. Some Members of Parliament have been protesting against electricity supply companies being treated on lines different from those laid down in the case of local authorities. The Government, however, stuck to their point. The companies, said Mr. Bridgeman, Parliamentary Secretary to the Board of Trade, had raised money for their undertakings, and had submitted to certain obligations and restrictions in order to carry out a public duty. In return they had been promised certain terms of purchase in certain eventualities. Was it justice, he asked, to sweep all this on one side?

Into this evidence of the Government's desire to treat the companies reasonably the Stock Exchange electricity supply market has been disposed to read a more friendly attitude towards the industry than was presumed by the companies which circulated the recent strongly-worded statement against the Government Bill.

Kensingtons are ex their dividend of 2s. 6d. and St. James' are ex 3s. 6d. The prices have been marked down ½ in each case, but business remains as slack as ever. As an example, it may be mentioned that St. James' changed hands on July 4th, and there was not another bargain done in the shares for the rest of the month. In County ordinary a full fortnight went by without a solitary transaction during July. English Electrics have gone back to 24s. 3d.; the result of the debenture issue is considered disappointing. The stock, fully paid, stands at 91, a discount of 3 points on the price at which the stock was offered, and the preferences stand at 18s. 6d. Speculative investors who do not mind a long shot might add the ordinary shares, should the price fall to about 23s. 6d., to their strong boxes.

General Electric ordinary have eased off to 20½ and the £10 preference shares to their par value. New preference are changing hands on the basis of a pound. Siemens are a dull market for the moment, but other shares in this department are showing recovery from their recent weakness. Babcock & Wilcox have rallied to 3 13-16. Armament shares are better, and in spite of the labour chaos, the tendency amongst iron, coal, steel and engineering issues is rather less melancholy than it has been of late.

Home Railway stocks are no better. Undergrounds remain tolerably firm, thanks to the unexpected advance in the dividend on Underground Income bonds. Central Londons are a trifle better on the ½ per cent. increase in the dividend. All three "Assented" stocks stand at 63½, while of the non-assented, the ordinary is 48½, preferred 53½ (both ex dividend) and deferred 40. The last receives its dividend only once a year, as is the case, of course, with various other deferred stocks in the Home Railway list. The possibility of a stiffening amongst money rates has caused heaviness in the prior-charge securities, many of which are none too easy to sell at the present time.

Marconis have further recovered to 6½, the dividend increase more than compensating the Government award. Speculation has been actively engaged in computing what (if any) bonus the company will return to its shareholders out of the £590,000. Marconi preference have hardened to 5½, and Marines—said by some to be the "pick of the bunch"—are steady at 3½, but the other subsidiaries continue quiet.

Telegraph and telephone descriptions lean to the lower side. Indo-Europeans have shed 30s. to 53½. Eastern Extensions dropped ½ to 15½. Anglo-American preferred lost 1½ at 95. The market seems to have fallen out of fashion with the investor.

The foreign group shows no particular feature. Vague rumours are afloat that something is going to be done shortly in connection with the Mexican utility companies, but nobody pays much heed to such nebulous reports, and prices are unaltered. Brazilian Tractions keep hard at 64, while the Anglo-Argentine varieties attract no attention. Rubber shares present a harder appearance, but, once more, the paramount popularity of the oil market leaves rubbers completely in the shade.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Aug. 5, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies					
Brompton Ordinary	10	8	6½	—	£6 10 6
Charing Cross Ordinary	4	4	8	—	6 13 4
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 4
Chelsea	5	5	8½	—	4 16 0
City of London	8	8	11½	—	7 2 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	—	6 18 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	8½xd	—	6 11 0
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	5	6	8½	—	7 14 10
Metropolitan	4	5	2½	—	8 13 8
do. 4½ per cent. Pref.	4½	4½	6½	—	7 1 2
St. James' and Pall Mall	9	10	6½xd	—	6 16 6
South London	5	5	2½	—	7 5 6
South Metropolitan Pref.	7	7	90/6	—	6 16 7
Westminster Ordinary	9	8	5½	—	7 2 9
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95	—1½	6 5 6
do. Def.	1½	53/6	23½	—	7 8 0
Chile Telephone	8	8	6½	—	£ 18 6
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½	— ½	*5 4 0
Eastern Tel. Ord.	8	8	159½	—	*5 0 4
Globe Tel. and T. Ord.	7	8	15½	—	*5 5 10
do. do. Pref.	6	6	10½	—	5 14 -
Great Northern Tel.	22	22	28½xd	—	7 14 5
Indo-European	18	18	53½	—1½	6 18 8
Marconi	20	25	6⅝	+ 5/16	4 1 0
Oriental Telephone Ord.	15	10	2½	—	4 9 0
United R. Plate Tel.	8	8	7½	—	*5 8 8
West India and Panama	1/8	1/8	1½	—	*4 11 0
Western Telegraph	8	8	16½	—	*4 18 9
Home Rails.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1½	25½xd	—	4 17 4
do. District	Nil	Nil	23	— ½	Nil
Underground Electric Ordinary	Nil	Nil	8½	—	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	4	5	95½		*6 4 9
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams. First Pref.	5½	Nil	3/16	—	—
do. do. 2nd Pref.	—	—	2½	—	—
do. do. 5 Deb.	5	5	65	—	7 13 10
Brazil Tractions	—	—	64	—	—
Bombay Electric Pref.	6	6	11½xd	—	5 9 6
British Columbia Elec. Rly. Pfce.	5	5	56½	—	8 17 0
do. do. Preferred	Nil	2½	47½	—	5 5 3
do. do. Deferred	Nil	Nil	42½	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	58½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	50½	—	Nil
do. 1st Bonds	Nil	Nil	64½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 13/16	+ 1/16	3 17 6
British Aluminium Ord.	10	10	1½	—	6 8 1
British Insulated Ord.	25	12½	2½	—	6 17 8
British Westinghouse Pref.	7½	8	2 11/16	—	6 19 0
Callenders	25	25	9½	—	6 11 7
do. 6½ Pref.	6	6½	3½	—	6 8 10
Casimer-Kellner	25	20	2½	—	7 5 8
Edison-Swan, "A"	—	—	1½	—	6 0 0
do. do. 5 per cent. Deb.	4	5	75½	—	6 5 9
Electric Construction	10	10	1½	—	6 18 0
Gen. Elec. Pref.	6	6½	10	— ½	6 10 0
do. Ord.	10	10	23½	— ½	*4 17 0
Henley	25	25	2½	—	6 5 3
do. 4½ Pref.	4½	4½	3½	—	6 0 0
India-Rubber	15	15	17½	—	*5 15 1
Siemens Ord.	—	10	5½	— ½	*7 13 9
Telegraph Cop	30	30	25	—	4 17 0

*Dividends paid free of Income Tax.

BREAKDOWNS OF ELECTRICAL MACHINERY.

By Dr. G. W. WORRALL.

(*Concluded from page* 156.)

One would hardly think it necessary to have to emphasise the necessity of thorough mechanical construction in connection with stator and rotor cores, yet a few examples will suffice to show that this is the case.

In a two-phase induction motor of 180 H.P. the rotor core plates were clamped between two end rings by means of bolts passing inside, but not through the core ring. The core was keyed at one point on to the rotor arms, but the end rings were secured only by small grub screws, half into the end rings and half into the rotor arms to prevent longitudinal movement. The rotor core was thus in the form of a ring, which was entirely separate from the rotor arms or hub. Shortly after the motor was started up for the first time the rotor fouled the stator, and considerable damage was done to several stator bars. On examination, the rotor was found to be slightly eccentric, and was ground true on the outside: the motor was re-erected, but the same accident occurred again, and this time it was said to be due to a slight movement on the part of the pedestal bearings. After adjustment the motor ran satisfactorily again, but each time the motor was switched off a noise was heard which indicated that at a certain point in each revolution the rotor core moved on the hub. It was also noticed that when the rotor was hot a six-mil feeler could be inserted between the core and the rotor arms in the region opposite to the key way, but when the rotor cooled down the space was quite closed. It was evident, therefore, that the core was loose, and this probably accounted for the apparent eccentricity of the rotor in the first instance. The rotor was properly secured to the hub by screws through the arms and into the end plates, and after this had been done all symptoms of looseness disappeared. It is interesting to note that the makers have since changed their design of rotor.

A 750-KW., 2,200-volt, single-phase alternator running at 490 R.P.M. began to give a great deal of trouble within a few weeks of its erection. The tooth stampings of the stator in the neighbourhood of the ventilating ducts, and at the ends of the stator, broke off, forming in course of time holes one or two inches long between the conductors, small pieces of metal came away while the machine was running and being carried round in the air-gap, caused violent sparks to be emitted, eventually the conductors at one point were earthed, and a large hole was fused in the conductors in three adjacent slots and the two teeth between them. An attempt was made to improve the machine by painting the entire surface of the stator with shellac and plaster of Paris, and the holes as they occurred were filled in with the same material. The fault in this case was due to insufficient support of the stator teeth, and it is quite probable that the entire stator core was loose. The distance piece in the core duct consisted of a thick stamping with the teeth twisted through a right angle. The method of repair adopted did not prove very satisfactory, and later fibre wedges were driven into the ventilating ducts which proved successful in preventing further teeth breaking.

A three-phase, 750-KW., 440-volt turbo-alternator running at 1,500 R.P.M. after eight years gave serious trouble by one line of tooth stampings breaking off and earthing the stator bars on each side. It is quite possible that the trouble had been going on for some time, but it was not observed until the bars were earthed.

Some manufacturers do not appear to realise the necessity of providing efficient support for the teeth of rotor and stator cores. The magnetic pulsations which occur do not exert any considerable force, but are of very high frequency, and it is most probable that after a time the metal becomes fatigued and breaks off. The effects of fatigue are sometimes not apparent until the machine has been running for some years, as in the third example given above.

Core looseness is a frequent source of trouble in small machines, although it is so easy to avoid it by proper design and workmanship. Armature and rotor cores should always be built up on a cast-iron spider or sleeve as this provides a much sounder mechanical construction than when the core is built directly on the shaft. Bad workmanship can, however, defeat good design, and when shafts and spiders are packed with strips of metal, as is occasionally the case, a loose core is only to be expected. The present-day method of securing armature and rotor cores by circumferential keys is generally satisfactory, but great pressure must be applied to the core before fitting the keys, and the keys must be a good fit. Some makers have not the requisite plant for this, and are able to apply pressure to the core only with screw clamps. The keys in one 200-KW. D.C. machine dropped out, and the core plates were held together only by the armature conductors. After running in this condition the conductors earthed to the core, and on dismantling the fault was discovered.

Many manufacturers use a standard key and make up any slight variations in the length of the core by running in soft metal behind the key, this scarcely seems a workmanlike job. Wood blocks sometimes used as distance pieces in the core ventilating ducts is bad practice as the wood is very liable to come loose.

The connections external or internal to a machine or switch are often very badly made, and many serious accidents have resulted; a few examples follow: A 175-H.P., three-phase induction motor supplied from a private plant in a mill, commenced to hunt, and the hunting gradually increased in violence until the entire electrical system was surging, with the result that circuit switches tripped and the entire mill stopped. This occurred several times; the load on the faulty motor was then reduced, and the hunting was kept within such limits as not to disturb other portions of the system. The trouble was found to be due to a bad connection in one phase of the rotor starting switch. The connection consisted of a projecting stud on which was placed a cable lug secured by two nuts. The inner nut had crossed threads, and although tightly pressed on the lug in one part only, the lock nut was on for only half its thickness. Overheating had caused the contact surfaces to become fused, and eventually contact was practically broken.

A 70-H.P., three-phase motor overheated considerably although three other similar motors doing similar work ran quite satisfactorily. The fault was found to be due to a contact in the star delta starting switch which was entirely missing, so that although in star connection the motor was on the three phases of the supply, in mesh connection one phase was cut out.

Two 600-KW. turbo-alternators running at 3,000 R.P.M. broke down in succession after a few hours' running, owing to the rotor connections breaking off close to the slip rings. The connections were not properly secured. The rotor winding broke down to earth some time later, and when opened up it was found that although the connections at

the slip rings had been made secure after the breakdown they were left quite loose inside the end bell, and the insulation was almost rubbed away by abrasion against the inside of the fan casting.

Fatigue of metal is a very serious problem in the internal connections of an electrical machine. Vibration caused by out of balance, loose foundations, or relative movement of parts, sets up tremors which in course of time seriously weakens the metal. The most common occurrence is in the commutator connections of ordinary direct current motors and dynamos, but many other more serious examples have occurred.

A 370-kw. d.c. turbo-dynamo running at 2,500 r.p.m. failed repeatedly owing to the commutator lugs breaking at the corners. The lugs had sharp bends, but when new lugs without any sharp corners were fitted the trouble was not experienced again.

The exciter of a 750-kw. turbo-alternator running at 3,000 r.p.m. broke down in the commutator, the copper segments cracked across and the lower part of the V of one segment broke off. The armature was badly balanced and the vibration was no doubt responsible for the breakage.

The rotor of a 125-h.p., three-phase induction motor was wound with enamelled strip copper, the overhanging end connections were, however, not mechanically secured, in fact were quite springy. The high frequency rotor currents during the starting operation caused the copper strip to vibrate, and in time a succession of breakages occurred. In later designs of this type of rotor winding the end turns are secured by wire threaded through them, but even with this method some turns are often found loose.

The necessity for security of terminal connections and other parts cannot be too strongly emphasised, as very serious risk of breakdown and fire is often caused by faults in this direction.

An induction motor with a squirrel cage rotor is usually considered a most robust piece of machinery, but unfortunately this fact often causes the motor to be subjected to such arduous conditions of work and great abuse as no other type of motor would stand, and as a result it is on the average no freer from breakdowns. Except in the more recent designs the rotor is the weakest part, the contacts between the bars and the end rings become overheated and loose, and the stator frequently burns out due to the increased current taken by the motor.

The modern methods of brazing the joints, casting solid, or welding, are all satisfactory, but soldering and riveting are of very little use. If the joints remain good, a rotor should never need rewinding, even if the insulation of the bars in the slots is all burnt away.

Bearings are frequently the cause of serious trouble. A seized bearing is often a small matter compared with the damage which follows. It is this which makes a phosphor bronze bush preferable to white metal except in large machines which receive more attention, and where the airgap is large enough to prevent consequential damage. When the bearing heats up, the white metal melts and runs out and allows the rotor to drop on to the stationary part and damage the windings, whereas a phosphor bronze bush seldom causes such damage. The bush is more difficult to remove when seizure takes place, but that is not a serious matter. If the hot bearing is discovered in time and the machine is kept running while the bearing cools down, actual seizure may be prevented. Ball bearings are advocated by many makers, particularly for induction motors where the airgaps are very small, but these are not always very reliable in practice. While such bearings are suitable for steady drives where there are no sudden jolts such as occur in a stone or ore crusher, they are supplied by some manufacturers for all purposes without any discrimination. The jolts usually cause broken balls, and the only remedy is to substitute bushed bearings. Apart, however, from unsuitability under certain circumstances, one of the main troubles is in connection with the fitting of the bearings. The importance of this cannot be too strongly emphasised, as carelessness is responsible for many breakdowns, and a repair usually involves a complete new bearing, which is an expensive item.

Oil throwing is another bearing trouble, and it seems curious that in a series of motors built to the same standard one will throw oil while the others may be quite satisfactory in this respect. The forces which draw the oil out of the bearing are of very small magnitude, and the points to be observed in order to prevent the trouble, would, to an inexperienced mind, seem very trivial. . Oil throwing can be prevented, and it is pleasant to find that the best class of manufacturer is now running no risks, and takes proper measures without first trying to do without them. Some machines seem to develop oil-throwing propensities some time after they are put in service, this may be due to the special circumstances of the drive, such as the shape and size of pulley, the belt, arrangement of the ventilation; it may also be due to the nature of the lubricating oil, but is generally due to dirt on the oil throwers. The presence of very little dust will allow oil to creep past the oil throwers, and the centrifugal action which the oil throwers are supposed to cause, is of no avail. Oil throwers should be turned solid with the shaft, as if they are loose, oil will sometimes creep along the shaft under the oil thrower.

Access to bearings during running is of great importance, great carelessness is often shown in the arrangement of the pulley in two-bearing machines, the pulley often is so close to the bearing that the inspection hole is shrouded, and the rings cannot be seen at work. At one works not only was this the case, but the outer bearing was in a hole in a brick wall.

Case after case could be cited of costly breakdowns which might have been prevented by a little more care being given to the bearings.

Some manufacturers do not take the trouble to make any inquiries regarding the conditions under which the electrical plant is to work, and many of the troubles which are experienced might be obviated if some attention were paid to suitability. It is often a question of price, and the manufacturer may find it difficult to persuade a customer to pay extra for a more suitable machine or switch, but there are many cases in which price scarcely comes in, and it is only a matter of thoughtlessness on the part of the designer of the installation. For instance, many excellent installations are considerably reduced in reliability by a poor quality regulator in the exciter circuit, or a weak cross bar on a circuit breaker; locknuts are usually left off the connections behind the switchboards, the springs on motor switches are often not securely attached, the handles on starting switches break off or become loose, switch and fuse contacts open and lose their springiness. Examples will no doubt occur to everyone, and it seems a great mistake not to pay more attention to such matters.

The contract for the electrical equipment of a certain cotton mill contained a clause that if during the guarantee period the entire mill were stopped for a continuous period of two hours due to a fault, a heavy penalty could be enforced. The generator, cables, motors, and motor switchgear were all of first-class quality, nothing in the workmanship was left to chance, yet the regulating resistance in the shunt circuit of the exciter was of the most indifferent quality. This resistance showed signs of overheating, and as a precaution a second resistance of the same pattern was installed by the contractors as a stand-by. It was fortunate that the precaution was taken for one or other of the resistances failed several times before a more robust piece of apparatus was supplied.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

(Concluded from page 134.)

Post-War Problems.

By H. England.

(Abstract.)

Finance.—We have to find a way so to adjust affairs that tramway revenues shall be sufficient to enable operators to pay wages and purchase materials for daily use, and to leave a margin to pay a fair return on the capital invested in the undertaking, and also accumulate a renewals or reserve fund to replace the wasting assets at the end of their lives. Income is therefore our first consideration at the moment, and we are up against a grave difficulty. The revenue of a tramway undertaking can be increased: first, by charging each passenger a higher fare, and secondly, by carrying a greater number of passengers.

Statutory undertakings have been badly hit by the conditions arising out of the war and the consequent depreciation in the coinage. The man in the street has re-adjusted his ideas of values as regards clothing, food, amusements, &c., &c., but when travel is concerned he seems to take a different view and demands his post-war privileges at pre-war prices.

Perhaps the Board of Trade is the stumbling block, and we should not blame the consumer at this stage, because in most instances the public have readily assented to an increased charge, recognising the impossibility of having the same facilities at the pre-war price.

Our difficulty is to find a way of making the Government department see reason and to grant us relief before our undertakings get into a state of disrepair and inefficiency.

Company-owned undertakings are in a different category to Corporation tramways in this respect, but it cannot be good for the town or the State to have rate-aided tramways, and the only sound and lasting method is to conduct a trading concern on a self-supporting basis. As regards companies, it is apparent that unless the capital charges are met the company must go out of business.

We must have a sufficient income, and, in my opinion, the only way to obtain the revenue is to charge each passenger the sum it costs to carry him the distance he travels.

Why we should be restricted to such absurd fare limits at this day I cannot see, because the public are fully able to take care of themselves, and if we foolishly demand an exorbitant fare, our business will disappear and our last state will be worse than the present. There is an economic limit to fares chargeable on a tramway, and as soon as that limit is exceeded away goes the business.

Whilst speaking of fares I should mention for your consideration the advisability of demanding powers to charge higher fares on Sundays, Bank Holidays, gala days, race meetings, and special occasions. We are called upon to pay higher wages on these days, it costs more to give the service, and we are entitled to increase our charges. Not only so, but the great bulk of the traffic on these days is purely pleasure, as distinguished from commercial traffic, and it cannot be argued that a higher fare would be in any way a restraint on trade.

Again, there is that bugbear of workmen's fares. Surely it is high time that anomaly was swept away. The so-called working classes are now drawing more cash per week than the middle classes, or even many professional men. I have dealt with the fare question, and I have very little to say about the alternative. The great majority of systems are full to capacity, and it is a vain hope to look for relief from additional passengers. The net result on most systems, if additional passengers involve a greater number of cars in service, will be adverse.

We now come to the other side of the ledger. Wages and conditions of employment in the tramway industry have kept pace with, or even outstripped, the demands made upon other industries, and the only difference is that whilst the increased charges necessitated are passed on by the trader or manufacturer, we are called upon to do the impossible and carry the burden ourselves. As regards materials, the position is chaotic. We are paying any prices asked by the manufacturers, and even then have difficulty in obtaining deliveries. I am tempted to ask whether we cannot do a great deal more to help ourselves in this matter. Surely a way can be found to standardise the bulk of our daily stores, and to buy on a co-operative basis. Things have come to such a pass that we must put aside all our little preferences and prejudices, and the engineer who must have something different of his own design, simply because it is his own, must go with the crowd and help bulk production and to diminish cost.

Let us encourage brains and inventiveness by all means, but set up a standing committee to consider and decide upon suggested improvements to standardised articles; but keep them standardised, embodying all the improvements that are discovered from time to time.

To illustrate my meaning, take gear wheels as an instance. I take it that no manager would have any objection to stating now how many gear wheels of a certain class he would want for next year. His sole object is to get the best quality gear wheel at the lowest market price, and the only way to do this is for a manufacturer to be employed as constantly as possible on a particular type of gear. Why cannot this be done? By organisation bulk orders can be placed, not only for gears, but almost all the materials we use; we should benefit by quality, workmanship and price, and the manufacturer by increased output and economy of production. I think that a revolution in order placing can be brought about with advantage to all concerned, and I trust this suggestion will be fully considered.

My next point in the finance problem is depreciation, renewals, or reserves. In 1900 and subsequent years, when electric tramways were being installed at a rapid rate, renewal funds were calculated and set aside on the basis of prices then prevailing. The funds have accumulated, and now, when renewals are required, we are horrified to find that the cash available is about 60 per cent. less than will be required to renew our wasting assets at prices now current. The only solution of this problem is to earmark every possible penny for renewals, and any balance will have to come out of revenue.

There is another disagreeable item in connection with reserve or renewal funds that are invested in securities. Almost all securities have depreciated, and it is apparent that when we have to realise to enable work to be undertaken we shall get back much less than we put in, so that we seem to be hit on all sides.

Rolling Stock.—The problem here is one often discussed, but recently with gathering force, viz., is the design of the cars we now use the right one, and are the materials the best for the purpose? We seem to be committed to ugly, unwieldly double-deck tramcars, and I am afraid the time has gone by when any radical alteration will be made on systems now in operation.

The only thing that can be said in favour of the cars at present in use is the seating capacity, but many objections can be raised to their use, the chief being excessive weight, time taken in loading and unloading, difficulty of fare collection, and so on.

Excessive weight per axle not only means large maintenance costs of cars, but it also carries with it heavy maintenance cost of track, and as these are the two chief items in the repair bill of a tramway undertaking, we cannot pay too much attention to them.

Nobody will contradict the statement that cars fitted with roof covers are the acme of ugliness, current gluttons, and voracious enemies of rails. The question is, are we on the right ilnes regarding cars, and is it too late to make a change, if a change is found to be desirable?

I really think this matter should be fully investigated, and we ought not to go on blindly buying cars of this pattern simply because the other fellow does so.

One thing is certain, the design of cars should be simplified; a freer use should be made of steel and malleable iron, and the use of wooden corner posts and intermediate pillars, which in many cases require renewal in a few years' time owing to dry rot, &c., should be stopped. We should eliminate all brass work, gold leaf, and fancy stunts of that description. They are not necessary to make a car look clean and attractive, but swallow labour, and are a continual source of annoyance and expense. We want no carved or pressed woodwork or fancy mouldings, either in the upper or lower saloons. We want no places where dust can lodge and which require daily cleaning; in fact, the plainer the interior of a car can be made, the better from the upkeep point of view and also for the health of the passengers.

Car equipments should give ample clearances. Equipments are on the market to-day that only give a clearance of from two to three inches between the rail head and the bottom of the gear case. This is not sufficient, and if we are to get the best out of our tires and gear cases, equipments must be designed to give much better clearances.

The present springing of cars is faulty. It is a sure indication that this is a recognised fault when one finds managers all over the country experimenting and trying dodges to improve springing. Wherever I go I find that some alteration has been made in the springing.

Maintenance of Roads.—Under present traffic conditions, the abnormal growth of heavy motor traffic, and general wear and tear of wheeled traffic, the upkeep of the paving between tramway tracks and on the 18-in. margins has become a terrible tax on all tramways. Unfortunately the paving is not the sum total of the damage; the concrete foundations of tramways also suffer severely. I have noticed, particularly in places where the concrete foundation only extends to the width of that portion of the road maintainable by the tramways, that in innumerable instances the concrete has broken longitudinally with the rail, and—in my opinion—this damage is caused by the passage of heavy vehicles on the unsupported portion of the concrete.

In places where the whole width of the road, from kerb to kerb, is concreted, such cracks are not often found, but I cannot suggest any solution to this problem unless the local authorities can be persuaded to excavate and concrete their roads when the rails and road bed of tramways are due for renewal. Is it possible for us to get any relief regarding the maintenance of road surfaces? Conditions are daily becoming worse, because of the great increase in the number of heavy vehicles, and road maintenance is growing fast. Why we as tramway

operators should bear the entire cost of maintaining road surfaces which we do not use I cannot imagine.

Motor 'Buses.—Motor 'buses have forged ahead during recent years, and I am wondering what their future is in relation to the passenger-carrying industry in this country. The motor 'bus is rapidly gaining a place that many people a few years ago thought unlikely. I have come to the conclusion that motor 'buses in provincial towns cannot compete successfully with tramcars for handling dense rushes of traffic, but in the future tramway tracks will not be laid into urban and country districts serving comparatively sparse populations, and in such districts the motor 'bus is undoubtedly the vehicle of the future.

The cost of carrying a passenger is the measure of economy as between 'buses and tramcars. By cost I mean all charges—operating, capital and renewals—and there is a wide margin at present in favour of cars under provincial conditions.

The question of road maintenance, or rather of bad adaptation and maintenance, is throttling the motor-'bus business at present, and until this question is settled on a national basis, the motor 'bus will not take its rightful place as a passenger-carrying vehicle in this country.

Of late most exorbitant demands have been made by road authorities on 'bus owners and operators, and the matter has got to such a pitch that something will have to be done, and done quickly, to decide this question.

Corporations are agreeing to pay road authorities a round sum for road adaptation, and a contribution per 'bus mile for road maintenance. One company of which I have knowledge is paying the ridiculous sum of 3d. per 'bus mile for road maintenance charges, and Corporations have even made an offer of such a sum as £700 per mile towards road adaptation.

A company which is subject to the whim of licensing authorities is obviously not in a position to pay down a lump sum for adaptation, even if such a charge were fair and reasonable, but unless a company is agreeable to pay a contribution for road maintenance, I think it will have great difficulty in getting licences.

This is a national question, and one that should not be left to every small road authority to meddle with. If we have to pay a contribution for road maintenance, let everybody pay alike, but I do think it most unfair to compel passenger-carrying vehicles to contribute and leave trade vehicles of double the weight and of equal speed absolutely free of all charges. I think it is illogical to make any charge on a particular class of vehicle; the roads should be put in a condition fit to carry present-day traffic, which of course includes motor 'buses, and no charge whatever should be made.

Housing.—Many local authorities are now considering housing and town-planning schemes. Tramways are required, and as many of the housing sites are some distance from the centres of the towns, some means will have to be found to serve the people who will reside in the houses. Extensions of tramways at to-day's prices are unthinkable unless assistance is afforded by the authorities, and even then, in the present unsettled state of affairs in the traction world, I question whether any company is warranted in sinking money to meet demands which in all likelihood cannot yield an adequate return for some years on the capital it will be necessary to expend.

It is a pity that tramway companies, owing to insecurity of tenure, and, at the best, limitation of tenure, are prohibited from entertaining extensions which are necessary for the development of the districts they serve.

In the past, company tramways have been constructed and services run in districts that were really not ripe for development at the time when the tramways were laid, but in the hope and expectation of future profits, services in excess of public requirements have been run to induce traffic, and now, when the period of patient waiting is beginning to be rewarded, companies are faced with excessive charges in all directions and their meagre profits seem likely entirely to disappear.

The efforts of companies have of recent years been sterilised because of the powers of purchase which may be exercised by local authorities, and in many cases the period at which local authorities are empowered to purchase is drawing near, so that it is quite impossible for any company to put down new lines unless assured of an immediate return.

A corporation tramway department would be affected rather differently by the various town-planning schemes, but even corporations will have to step warily, otherwise the department will find itself operating a considerable mileage of tramways at a loss.

I assume that care will be taken that whenever sites are laid out for new buildings, roads will be made wide enough to give a high-speed tramway track free from other traffic, and on these lines the future development of tramways in this country will depend.

We have sacrificed speed, and have made what are virtually street railways into a hybrid between a hackney carriage and a private brougham. We stop our cars at every street corner, and even then get complaints that the wife of a town councillor has to carry her parcels 20 yards from the car to her door step.

The time has come when this sort of thing should be stopped, and our tramways should take their rightful place in the traction world, and be regarded as high-speed street railways, leaving the finicking door-to-door traffic to a different class of vehicle entirely.

Employment for Disabled Men and Spare Hands.—On some systems the task of finding suitable work for disabled men has proved very serious. It is bad for the job generally to have a man who is regarded as a pensioner, and who is not doing his "whack" on the premises, and unless work of a suitable nature can be found for such a man, I think it would be almost better to allow him a sum, if there is any moral obligation so to do, and tell him to stay away.

Many undertakings have a sufficiently serious problem to solve regarding spare men, particularly places catering for a seasonal traffic or where the traffic is irregular and fluctuating.

This is one of the problems brought about by the last wages settlement, and it is the general opinion of most of the managers with whom I have come in contact that there is not sufficient elasticity, considering the peculiar nature of tramway employment.

If public demands are to be met, we must run our cars regularly and on time, and to ensure that this is done we must have available a percentage of men to understudy those who may be sick or idle or who have missed their duty because of other reasons.

"Made" work pays nobody, and in very few instances has it been found possible to provide suitable work of a remunerative character for men who are not required to drive or conduct but who have to be paid.

Skilled and Unskilled Labour.—The tendency of the day is for unskilled labour to demand and obtain the same rates of pay as skilled labour, and if this is to continue I wonder what the result will be. Are we to denude the country of skilled craftsmen? Really that is where the present day development will lead, and I cannot think the peril of this is realised by those who have so freely granted the extortionate demands of unskilled labour. There is no incentive for any youth to stick to a particular trade and to make himself an efficient and capable craftsman, and in days to come we shall have a race of handy-men, jacks of all trades, incapable of doing a first-class job in any particular calling.

Peak Loads.—Cannot some effective steps be taken to flatten our peak loads? During the war an effort was made in this direction, but the response of labour was negative. It means so much on a busy system to spread the peak-load rush over a wider period, and the advantages to the public are so patent, that one would have thought the proposal would have met with immediate acceptance. As the better distribution of traffic not only means improved facilities for the public but also a marked saving in the wear and tear of rolling stock, economy in the generation of electrical energy, and to some extent diminution of split turns, a further effort should be made to stagger the hours of commencing and finishing work.

Conclusions.—There are several problems we shall be called upon to face, either now or in the immediate future, in addition to those I have dealt with: the traffic problem in large cities and the difficulty of providing transport; power house difficulties; price and calorific value of fuel; provision of new plant and position of owners of generating stations under the new Act; restoration of efficiency of organisation and equipment; electrification of local railway systems.

These are only some of the many problems that can fittingly be discussed. One other matter I wish to mention, viz., publicity. For some time past I have held the opinion that we are sadly lacking in propagandism. We have a lot to gain by letting the public know many things we now keep locked up in our bosoms. A transport concern is open to the carping criticism of every jackanapes who has the effrontery to raise his voice, and we suffer misapprehension and calumny at the hands of the few. That is immaterial if we are understood by the many, and our limitations and difficulties appreciated by the public at large. I have heard it said that a tramway company, by the very nature of its business, can never be popular, but we can reduce that inevitable unpopularity to negligible proportions by judicious publicity and an effort to make the public understand.

Discussion.

Mr. E. H. Edwardes agreed as to the necessity of standardisation; up to the present it had been tackled in a somewhat slovenly way, and but little had been standardised as yet. The design of cars depended on the system concerned; they wanted cars with a large seating capacity. Referring to the subject of low clearance, he said he had no gear cases on his cars—they could not be kept on.

Mr. Humphries considered that during the last 10 years a great deal of standardisation had been accomplished, but some tramway managers would not fall into line. In ordering new parts they should consult the makers, with a view to using standard designs. With regard to the type of car, the Americans were strongly in favour of the "safety" car, with vestibule ends, and seating 34 passengers; this type of car was gaining ground in the United States in preference to heavy cars. On tracks of 3½ ft. gauge the single-deck car had a great future; quite a number were in use in the Black Country, mainly on inter-urban routes, and were earning as much per car-mile as double-deck cars with top covers; with the same consumption of energy they could give a much more frequent service and a higher speed.

Mr. A. L. Barber, referring to the electrification of railways, said that the L. & S.W. Electric Railway paralleled the London United Tramways near Richmond; the tramways had lost a little of their long-distance traffic, but none of their local traffic, and gained a number of passengers on holidays.

Mr. C. W. Mallins said that improvements could not be introduced without an alteration in the fares. The Act of 1870 was a stumbling-block, and the Board of Trade set its face against the increase of fares. High-speed transportation was absolutely essential, but some means must be found for separating the short-distance from the long-distance passengers. The conditions obtaining at Glasgow were different from those prevailing in any other city, owing to the density of the population in the central area. They could not separate the passengers on an ordinary tramway, but he suggested that omnibuses might be used to deal with the long-distance traffic. It was to the interest of all of them to co-operate in securing an alteration of the law, so that they would be able to meet their liabilities as they should. Difficulties could be seen ahead; there would have to be an enormous outlay on renewals in the future, and they must get sanction for proper fares. The passenger ought to pay a reasonable price for his ride.

Mr. Benedict suggested that the Council should confer with the British Engineering Standards Association on the subject of standardisation.

The Chairman, Mr. R. J. Howley, said that the British Engineering Standards Association was occupied in standardising many things connected with tramways—wheels, axles, wheel centres, &c. The Council of the Tramways Association had recently decided to set up a Standing Technical Committee. The future work of the Association would tend largely towards standardisation of the technical work of the industry. The new Council would form the committee, which would work in collaboration with the British Engineering Standards Association.

The present overcrowding trouble could only be overcome by the expenditure of capital, and that could only be done if the undertakings were in a prosperous condition; the situation called for a large increase in rolling stock, on both railways and tramways, and an undertaking which was not financially successful could not deal with it. They should carefully prepare a case to set before the authorities in order to secure relief from the maintenance of roads, &c. The deferred repairs and delayed renewals constituted a very important question; if the cost of upkeep were fully allowed for to-day, very few undertakings could claim to be working at a profit. With regard to the provision for the temporary increase of charges, the Act required an undertaking to show a *loss* before relief could be given—a very detrimental position; he hoped that the new Transport Department would take a wider view of the circumstances.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(Continued from page 136.)

The Rawlplug Co., Lenthall Place, Gloucester Road, South Kensington, S.W., showed plugs made of patent fibre and used for fixing screws into any material, including metal. They are suitable for use in any trade, and for fixing anything that is held by screws, for instance, electrical fittings, wires, cables, &c. Rawlplugs do not require skilled handling, nor do they damage the surrounding material, and they are invisible when in position; we have already described them on page 248 of our issue of February 28th last. The exhibit include specimens of work in all calsses of materials; examples of wiring and fixtures on marble, stone, glass, slate, &c., were shown, as well as work on plaster and brick. Demonstrations of the use of rawlplugs and the advantages over the usual method of obtaining a fixture and speed tests were given, as were also demonstrations and tests of the strain that the plugs will stand in any material. A No. 14 2-in. screw fixed with a rawlplug in stock brick will withstand a direct pull of over half a ton. Demonstrations of the use of handy labour-saving tools (patented) for the purpose of making the small holes into which rawlplugs are fitted were also given.

Messrs. Guthrie & Co., Accrington, exhibited armoured centrifugal pumps manufactured from "Ceratherm" and used for particular chemical purposes. This firm has brought out a material which has been adopted on a large scale for chemical purposes, and which under special conditions might be found applicable to electrical purposes. "Ceratherm" is an acid and flame-proof earthenware composition; it is not affected in the slightest by corrosive liquids, not even by boiling acids, and having a much higher thermal conductivity than porcelain or stoneware, and also for other reasons, sudden and violent variations of temperature do not cause it to crack. It has the advantage that it can be made of considerable strength, but it is not of the brittle nature of porcelain, and is not liable to fly when made in the form of impellers.

The Sir John Cass Institute, Jewry Street, Aldgate, E.C.3. A cadmium vapour arc lamp was exhibited by Mr. H. J. S. Sand, D.Sc., which is similar in general principle to the well-known mercury vapour lamp. It is constructed of quartz glass, and to start the lamp the metal is melted by means of a Bunsen burner and the arc struck by tilting. The lamp gives a powerful light, and once started will continue to burn indefinitely. It is hoped that in addition to its use for purposes of optical measurement, in which lines of definite wave length and great intensity are required, the lamp will find application as a powerful source of red and ultra-violet light. An X-ray localising slide rule, designed by Mr. F. J. Harlow, B.Sc., A.R.C.Sc., D.I.C., and manufactured by Messrs. F. R. Butt & Co., 147, Wardour Street, London, W.1, was also exhibited. This instrument has been adopted by the British War Office and supplied with all house and field hospital X-ray outfits. It is an adaptation of the mathematical slide rule for the purpose of localising foreign bodies from measurements made during X-ray examination of the patient. The logarithmic scales are so arranged that the depth and the lateral distances of the foreign body from two cross wires can be read off for any tube shift and any distance between anti-cathode and screen or plate by three simple settings of the sliding scale and cursor.

The British Glass Wool Co., Ltd., Britannia Works, Lowman Road, London, N.7, exhibited glass wool free from lead and borax, for the filtration of acids, alkaline solutions, &c., and also for use in electric batteries.

The British Cellulose & Chemical Manufacturing Co., Ltd., 8, Waterloo Place, London, S.W.1, exhibited cellulose acetate, a chemically treated vegetable fibre, which forms the basic material of non-inflammable celluloid, non-inflammable kinema films, artificial silk, electrical insulators, varnishes, &c., samples of all of which were shown. Doped wire and fabric netting have their interstices filled with a thin, transparent and flexible film, forming an excellent substitute for glass where ease of transport and unbreakable qualities are desired. Artificial silk, the beautiful imitation of the real article, is one of the most interesting achievements of modern science, while cellulose acetate owes its value for insulating varnish and tubes to its high insulating properties, resistance to heat and damp and facility of application.

The Concordia Electric Wire Co., Ltd., Trent Mills, New Sawley ,Derbyshire, showed a selection of bare, silk and cotton covered and enamelled copper and high resistance wire, cable, sheet, strip and ribbon as well as asbestos and asbestin covered copper and high resistance wire; bell and telephone wire and cable; charcoal iron wire; armature binding wire; fuse wire; medical and flexible cords and insulating materials of various classes.

The Runbaken Magneto Co., Ltd., Cheetwood Lane, Derby Street, Manchester, exhibited high-tension magnetos, working models of the same and testing apparatus; also moulding in ebonite and stabilite, sparking plugs and distributors and accumulators. This firm has introduced an aluminium commutator of which a number are now in use, and are said to be giving satisfaction. The housing is of aluminium, the sectors being accurately fitted into fibre specially treated to avoid warping. The rotor is constructed on the usual lines. To fill a want by garages and repair depôts a magnetiser and automatic foot switch has been introduced which obviates the delay and expense of sending a magneto back to the makers. The magnetiser is supplied to work at 100 to 150 and 200 to 250 volts; where a supply of electricity is not available, accumulators may be used, and magnetisers can be supplied wound to work at 12 volts.

The Dowsing Radiant Heat Co., Ltd., 39-40, York Place, Baker Street, London, W.1, exhibited electrically heated apparatus of all descriptions. Elements, wound on mica and porcelain grids, of various capacities for both domestic and industrial uses were shown. Domestic appliances included

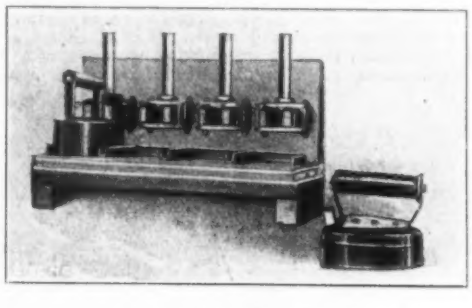


Fig. 13.—Cordless Irons.

radiators, kettles, saucepans, urns, hot plates, toasters, and electric irons of various types and sizes. Commercial appliances included soldering irons, glue pots, wax heaters, branders, presses, water heaters, letter dryers, luminous and non-luminous radiators, and the patent cordless system of heating irons whereby the iron is heated automatically without connecting cords. These irons, when hot, may be disconnected from the source of supply and used with the same freedom and convenience as solid irons. They are heated by

being placed against substantial contact springs inside cast-iron housings, which are provided with guides and are usually mounted on strong fire-proof shelves attached to the wall. These cordless "hot-point" irons (fig. 13) have heavy pillars in place of the usual pins and connectors; according to shape and size their weight is from 4 to 22 lb. and the consumption from 275 to 500 watts. Comparative tests are said to have given the following records:—

Test made at—	No. of irons.	Cost per week. Gas.	Cost per week. Electricity.	Result.
London ...	5	7s. 8½d.	4s. 6½d.	120 irons installed.
Newcastle	3	4s. 1d.	3s. 0½d.	46 „ „
Brighton	8	18s. 5d.	13s. 4d.	12 „ „

The system is doubly automatic; no current at all is used except when the irons are against the contacts, the irons then heat up rapidly, and as they warm up the current is gradually cut down to a normal amount. The irons do not overheat, there is no waste of heat, no fumes, and the system is really economical in running cost.

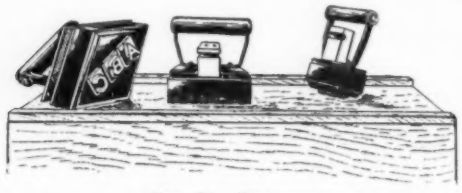


Fig. 14.—Branders.

Branders are made in a similar manner to the "hot-point" irons, with plenty of heavy wire, made of a non-automatic alloy, which permits the temperature to rise to a dull red heat. The design is cut in relief on the face of the iron as seen in fig. 14, or, if necessary, the letters can be made changeable. The consumption of electricity can be arranged to be the most economical for the particular work required if

Fig. 15.—Shaving Pot.

Fig. 16.—Milk-heater.

full particulars of nature of wood, leather, felt, or other material and number of brands to be made per minute are given; bacon branders of circular or oval shape may be cut on the rectangular bases. Fig. 15 shows a copper shaving pot, the interior being tinned, which has a capacity of ½ pint and a consumption of 210 watts. Fig. 16 shows a nickel-plated saucepan; these are made with capacities of ½, 1 and 2 pints and consumptions of 250, 400 and 500 watts respectively.

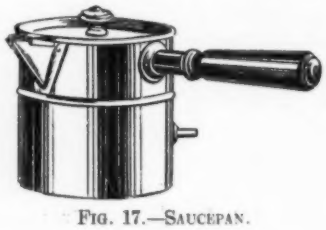


Fig. 17.—Saucepan.

Fig. 17 shows a nickel-plated milk heater with a porcelain container; they are made in 1½ and 3 pints' capacities and consume 400 to 750 watts.

Special forms of electrically heated medical appliances, such as instrument sterilisers, and for the radiant heat system of treatment and other heat applications were exhibited, as were also electrically heated clothing, cloths, mats, rugs, cushions, &c. Electrically heated fabrics were first made in England, and patented in 1894 by Col. R. E. B. Crompton, C.B., R.E., in conjunction with Mr. H. J. Dowsing, M.I.E.E. Of late years considerable progress has been made in the manufacture of electrically heated garments, and the exhibitors have been able to supply, to designs suggested by the Royal Air Force, garments which effectually keep pilots in flying trim, even when they have to face extremely low temperatures. The garments are made of wash-leather or gabardine, the linings being supplied with the heating elements. Two methods are employed; in the first, crinkled wire covered with asbestos, or heat-resisting material, is employed and sewn over the coat, while wires run down the sleeves extending to the gloves and to the loose socks in the airman's boots. The manner in which the wires are distributed is clearly shown in fig. 18. The plug almost in the centre of the waistcoat conducts the current from the source of supply completely round the body and to the sleeves; the one at the bottom of the waistcoat is connected directly to the socks, and the two on the sleeves serve the gloves.

Special non-corrosive nichrome wire, which will stand great heat, is employed, and for such articles as gloves, in which extreme flexibility is desirable, seven-strand wire covered with a heat-resisting tape is used. In the second system separate heaters are employed, which consist of flat nichrome wire wound on mica strips, which are themselves held between two broad mica strips contained in a fibre case. The connections are pins or press-stud fasteners, which are instantly detachable and make good contact. The heaters are carried in

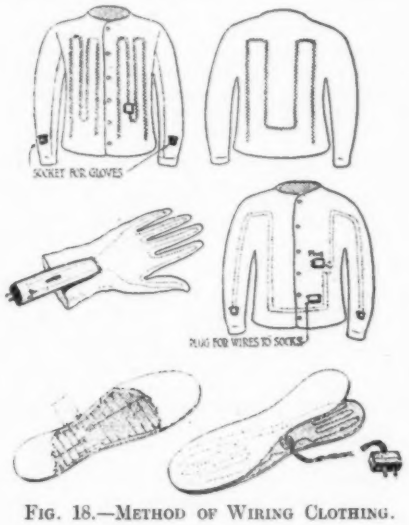


Fig. 18.—Method of Wiring Clothing.

three inside pockets, two at the front and one at the back of the body. The same principles are adopted in the case of the socks, which are of two patterns. The gloves are made of thin material, and the presence of the wires is hardly noticeable. They are designed to be worn inside gauntlets, so that if the latter be removed the wearer can manipulate levers or switches without the slightest difficulty, and at the same time without getting his hands cold. As regards the current used, the waistcoat takes 2.5 amps., the gloves 0.75 amp. each, and the socks 1 amp., the supply being derived from an ordinary 12-volt motor-car lighting set or battery.

(To be continued.)

H.P., A.C. Cables.—According to Dr. W. Kummer, of Zurich, the prejudice in favour of the use of H.P., A.C. overhead transmission lines is beginning to weaken, and the advantages of underground transmission to become better appreciated. In considering the problem, there are two points to which special attention should be directed:—(1) The potential difference between the two extremities of the conductors both when unloaded and when fully loaded; (2) the current passing when the conductors are not loaded. He discusses both these conditions mathematically in *Schweizerische Bauzeitung* for May 10th, and accepts Dr. Humann's assumption that the external diameter of a cable for underground work should not exceed 100 mm. diameter over the insulation, and a pressure of 5,000 volts on the inner millimetre of the paper insulation. This has a dielectric resistance of 20,000 volts per mm. for the insulation between the copper conductor and the external lead covering of the cable. The highest absolute difference of potential between the conductor and earth of 92,000 volts is given with a single conductor cable where the copper is 36 mm diameter, and the insulation has a radial thickness of 32 mm. With the zero point of the transformers earthed, such a cable would safely carry either single-phase current at 184,000 volts, or polyphase at 159,000 volts, and a current of 800 amperes. The author then discusses the effects of periodicity.—*Technical Supplement to the Review of the Foreign Press.*

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The British Engineering Standards Association held its first general meeting on Friday, July 11th, at the Institution of Civil Engineers, when the Chairman, Sir Archibald Denny, Bart., in presenting the report of the work in hand and contemplated, made a brief review of the position. He said that the Association now numbered some 360 committees and panels, manned by about 1,200 members, who gave their time and experience, often at great personal expense and inconvenience, to that work of national importance. The Association, as well as the whole of the industry of the country generally, owed a deep debt of gratitude to its members for their loyal service, and also to the engineering firms which, by giving permission to their engineers, managers and other of their employés to take part in the work, made thereby a contribution which was possibly not as fully realised by the public and members as it should be, though on the other hand it was certainly very much appreciated by the Executive.

The chief work of the Association at present was the revision of the standard sections for structural steel, the standardisation of aircraft components, automobile parts, electrical machinery and apparatus—which section was expanding very materially as the electrical industry made greater demands for standards—railway materials, machine tools, limit gauges, screw threads, shipbuilding materials and the details in the construction of ships and their machinery and other miscellaneous subjects.

The Association was establishing, in a number of foreign countries and overseas dominions, local standards committees of British engineers and traders in order to disseminate British standards and so assist British manufacturers in developing their foreign trade. A short report had been issued to subscribers to that particular section of the Association's activities, as well as to a large number of interested people and trade organisations, in order that they might have some details before them of the actual progress made and consider to what extent they could still further associate themselves with the scheme and promote its success.

So far as the financial aspect of the overseas scheme was concerned, no provision had yet been made for recurring expenditure, and that would have to be taken seriously into account in the near future if the local committees were to be in a position to assist the industry to the fullest extent. The British Chambers of Commerce were now co-operating in the work, which would have a material effect on the financial side, and help the work forward in every way, and it was earnestly hoped that trade organisations would take a direct interest in those local committees and assist the Association in attaining the object in view, especially as it was the intention to invite the Governments of the different countries to nominate technical officers from their large spending departments to sit on the committees.

The Association had translated a number of its more important specifications into Spanish, Portuguese, Italian and French, and distributed them in considerable quantities to the various local committees.

The committees had been formed through the assistance of the Foreign Office and the Overseas Department of the Board of Trade, which had placed the services of the Consular Officers and Commercial Attachés and the Board of Trade Commissioners at the disposal of the Association, and those gentlemen had been and were giving valuable assistance. It had been a very striking development on the part of the Government, which had subscribed £10,000 in support of the work, industry generally having subscribed some £14,000.

So far as the Dominions were concerned, the South African Engineering Standards Committee had agreed to act as the representative committee of the Association in the Union. The Canadian Committee, recently incorporated under Dominion Charter, was acting as the Association's representative in Canada, and would take every opportunity of familiarising Canadian engineers with British standards. In Australia an Engineering Standards Committee was on the point of formation, and there was every hope and indication of Australia's working in close co-operation with the British Association and using British standards wherever those were applicable.

With regard to international work, Engineering Standards Committees were now being formed, on similar lines to those of the Association, in various foreign countries, the British Engineering Standards Association having been consulted in practically every case, and it was hoped that the experience gained during the past 18 years, freely placed at the disposal of these foreign committees, had proved of some assistance in building up their constitution.

The question of Anglo-American co-operation in particular had been considered in some detail. Professor Comfort Adams, the chairman, and Mr. H. M. Hobart, a member, had recently attended one of the meetings of the Main Committee as delegates of the American Engineering Standards Committee, and it had been decided to co-operate with the American engineers as closely as possible in all matters relating to engineering standards. As they had a common language and common weights and measures, that seemed a natural and easy step towards international action.

On the Continent various efforts had been made from time to time towards the formation of an international body for engineering standards, but it was felt that the time was scarcely ripe for such action, and that it would be preferable for some time to come to allow the national standardising bodies to organise and co-ordinate in their own particular fields, and to form international organisations for specific and separate branches of engineering only when they had advanced to somewhat the same level as had been done in England in national standardisation, and when the necessity for international agreement was shown, rather than to attempt such a colossal task as the formation of an international organisation for general engineering standardisation; moreover, the question of detailed international specifications was full of immense difficulties.

With regard to the adoption of standards, there was no doubt that British standards would be employed to a far wider degree than ever before. Constant demands for standardisation were coming from various Government Departments as well as from powerful industrial organisations, and there was a general feeling that some steps must be taken officially to encourage the use of British standards throughout the country by the Government Departments, municipalities, corporations, and, indeed, by all specifying engineers. Quite apart from the guarantee of quality obtained through the employment of British standard specifications for materials and machinery, the actual value of time saved through the use of those specifications was a far greater factor than was usually recognised, and, seeing how intimately connected standardisation was with national production, some such action could not fail to be of great assistance to the Association.

The accounts of the Association were presented, from which it appeared that the Association was still somewhat hampered in its free development due to the fact that sufficient funds were not yet at its disposal to enable it to be generously staffed and housed. The industry, however, was increasingly recognising the utility and importance of standardisation to the nation's production, and doubtless that would gradually be remedied.

The accounts were adopted, and Messrs. Deloitte, Plender, Griffiths & Co. were re-elected as auditors, a vote of thanks being accorded to them for their past work.

An interesting letter from Mr. D. N. Dunlop, director and secretary of the British Electrical and Allied Manufacturers' Association, dealing with the question of more efficient arrangements for collecting funds, was mentioned, and the Chairman stated that the Main Committee would take the matter into serious consideration in the early autumn.

A vote of thanks having been passed to the chairman and also to the secretary and his staff for their efficient work, the proceedings terminated.

REVIEWS.

George Westinghouse; His Life and Achievements. By Francis E. Leupp. London: John Murray. Pp. xii+304, with 11 illustrations. Price 15s. net.

George Westinghouse was a pioneer who lived to reach his goal, so far as anyone can be said to do so. In a field like engineering, in which finality is clearly unattainable, the reaching of any goal is, of course, a relative matter; but it is possible, nevertheless, to mark progress. And when a comparison is drawn between the state of things existing in engineering—railway, gas, electrical, and general—at the beginning of the career of George Westinghouse, and that which he left behind him, the progress brought about by his efforts is seen to be so great that it may well be considered to mark an epoch quite as clearly as the reign of a monarch.

He was not one of those whose fame is due in the main to the skill of others, though Westinghouse knew how to choose his men, and how to make the best use of them. He knew, too, something more than this, and that was how to inspire them with a loyalty and trust amounting to affection, so that when dark days came his staff rallied round him, and backed him with their money as well as with their brains and hands.

George Westinghouse was essentially practical. He was not a great scholar, like Kelvin; he wrote next to nothing, and left behind no voluminous notebooks, no diaries, and but few letters. His main assets were an inborn genius for actual constructional work, complete faith in himself, and a tremendous driving energy which carried him through difficulties to a conclusion almost invariably triumphant. The life of such a man contains much in the nature of inspiration for those who follow after. A man of the people, not backed by money, not specially favoured in any way, having opposition to overcome which would have daunted most men, he came through, and got there in spite of everything. What one man can do, others can attempt, and much would be accomplished that is now left undone, if men had the courage to persevere and persist when they *know* they are right. There is, of course, all the difference in the world between this and the rash impulsiveness which no sooner gets an idea than it rushes for fulfilment, and spends as much time in retreating as in advancing. The troubles which overtook, but did not overwhelm, George Westinghouse in later life were chiefly of a

financial nature. They were inherent, to a great extent, in the American financial system of the time, and as far as they did not arise from that cause they were due to fear—sometimes easily understandable—on the part of those accustomed to deal with certainties in the shape of hard cash. This fact exemplifies the folly of placing the government of a large business organisation in the counting-house. Accounting consists in the recording of the deeds of other people, and not in their accomplishment.

Mr. Leupp gives us a clear and correct conception of the man and of his work. As a book, this volume is written in an interesting manner, and is well got up, without many mistakes. The Italian who first made induction motors in Europe was Galileo Ferraris, not Ferrari, as stated on page 141. There is not, and never was, such an institution as "the Central Institute of Guilds of the City of London," referred to on page 174, though everyone knows what is meant. Nor, we think, was there a British Westinghouse Electric and Manufacturing Company in 1890; and when the Trafford Park works were built (in 1902) very little of any permanent value was effected by the Westinghouse organisation in the way of housing, in spite of Mr. Leupp's impression to the contrary on page 189. The book has an index, but there are some notable omissions—the British company is not mentioned, nor is George Westinghouse, senior, nor Albert the present King of the Belgians, mentioned on page 262 as having stayed sometime at Solitude, Westinghouse's Pittsburg residence.

The book is one which should find a place not only on the shelves of all engineers who love their profession, but in all school libraries. It is good that the imagination of the rising generation should be fired by the stories of the lives of those who have done great things. It seems something of a pity that the name of this great constructive genius is to disappear from the British electrical industry, to be replaced by a name which, however justly famous, is chiefly renowned for the manufacture of engines of destruction.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

18,087. "Coin-freed electrical shooting apparatus." V. C. Sampson. July 21st.

18,119. "Starting explosion engine with magneto." N. Harzmark. July 21st. (France, April 2nd.)

18,127. "Dry-cell batteries." H. R. Palmer. July 21st.

18,133. "Electric laundry irons." A. E. Fitzgerald. July 21st.

18,146. "Sparking plug for internal-conbustion engines." E. Goldsmid-Abrahams and W. S. Shepard. July 21st.

18,148. "Electric ovens." F. T. Hewson. July 21st.

18,150. "Automatic electric control of vehicles with electric transmission." P. V. Powell and P. F. Smith. July 21st.

18,166. "Line arrangements for automatic telephone exchanges." Relay Automatic Telephone Co. (G. A. Betulander.) July 21st.

18,167. "Switching arrangement for telephone exchanges." Relay Automatic Telephone Co. (G. A. Betulander.) July 21st.

18,233. "Telephone exchange system." Western Electric Co. July 22nd.

18,248. "Telephone systems." C. R. H. Arntzenius. July 22nd. (Holland, August 19th, 1918.)

18,254. "Electric signs." F. A. Smith. July 22nd.

18,257. "Wireless telegraph apparatus operating with relays." J. B. Bolitho. July 22nd.

18,284. "Apparatus for transmitting by electric current drawings, printed matter, &c., and projecting transmitted copy upon screen for advertising, &c." R. G. Cave and W. Goss. July 23rd.

18,294. "Sparking plugs for internal-combustion engines." F. W. Hill. July 23rd.

18,301. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. July 23rd. (United States, November 4th, 1918.)

18,305. "Dynamo electric machines." J. W. Burleigh. July 23rd.

18,319. "Wireless transmission of speech." E. C. Hanson. July 23rd.

18,320. "Electric ignition apparatus for internal-combustion engines." Remy Electric Co. July 23rd. (United States, September 19th, 1917.)

18,321. "Thermostatic devices." Relay Automatic Telephone Co. July 23rd.

18,327. "Electric lamps for motor vehicles." F. Goodman and H. Clayton-Wright. July 23rd.

18,336. "Trollies or current collectors for electric trams, &c." T. J. Smeddles. July 23rd.

18,363. "Electrical fuse and switches." W. Thornton. July 24th.

18,409. "Jointing lengths of troughings for laying electric cables." L. R. Lee. July 24th.

18,410. "Atmospheric discharge and disturbing element eliminator for wireless telegraphy." A. H. Branton and E. A. Bitton. July 24th.

18,411. "Dynamo electric machinery." T. L. R. Cooper. July 24th.

18,413. "Means for protecting electric mains against flooding on boardship." T. G. Hartwell. July 24th.

18,415. "Vacuum tube or electronic discharge apparatus." E. A. Graham and W. J. Ricketts. July 24th.

18,435. "Condensers." Dubilier Condenser Co. July 24th. (United States, August 1st, 1918.)

18,436. "Insulating testing devices." Dubilier Condenser Co. July 24th. (United States, August 26th, 1918.)

18,437. "Condenser structure." Dubilier Condenser Co. July 24th. (United States, March 7th.)

18,438. "High potential condensers." Dubilier Condenser Co. July 24th. (United States, March 7th.)

18,439. "Condenser plates." Dubilier Condenser Co. July 24th. (United States, April 11th.)

18,445. "High tension insulators." W. D. Slaney. July 24th.

18,458. "Electric signalling systems." Western Electric Co. (Western Electric Co.) July 24th.

18,462. "Electric switch lock." W. H. Cole. July 24th.

18,492. "Negative and positive resistance vacuum tube devices for wireless telegraphy, &c." J. Scott-Taggart. July 25th.

18,496. "Electric circuit breakers." Electrical Implements Ltd., and R. W. Gregory. July 25th.

18,505. "Production of electrical oscillations for radiotelegraphy or radiotelephony." F. J. Chambers. July 25th.

18,517. "Electric reactive windings." J. R. Beard & Electrical Implements, Ltd. July 25th.

18,522. "Wireless direction finding apparatus." C. K. Chandler. July 25th.

18,525. "Electrically operated diaphragm horns." H. W. Bradbury. July 25th.

18,548. "Hand and electrically propelled vehicles." W. H. Glaser. July 25th.

18,589. "Paul and ratchet gear having an electro-responsive releasing device. Aktiebolagett Svenska Kullagerfabriken. July 26th. (Sweden, July 27th, 1918.)

18,610. "Static electric condensers." British Thomson-Houston Co. and R. C. Clinker. July 26th.

18,612. "Thermo-electric appliances." W. H. Wilson. July 26th.

18,613. "Hand-operated electric switches." E. Mepstead. July 26th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

12,911. Wireless telegraph transmitters. Marconi's Wireless Telegraph Co. and C. S. Franklin. September 8th, 1917. (128,983.)

12,957. Ignition apparatus for internal-combustion engines. E. A. Watson and M.-L. Magneto Syndicate. September 10th, 1917. (128,985.)

13,544. Electric furnaces. British Thomson-Houston Co. (General Electric Co.) September 20th, 1917. (129,014.)

13,738. Electrically heated gloves and other flexible articles, such as boots, clothing, carpets, and the like. A. A. Lemercier. October 26th, 1916. (129,019.)

13,807. Mercury vapour lamps. M. J. Cornu. September 25th, 1916. (129,022.)

13,918. Electrode holders for electric furnaces. Spear & Jackson and G. Marriott. September 27th, 1917. (129,027.)

14,215. Electric furnace control apparatus. British Thomson-Houston Co. (General Electric Co.) October 2nd, 1917. (129,039.)

19,335. Cord terminals or connectors adapted for connecting electrical conductors. A. E. Francis. December 31st, 1917. (129,045.)

1918.

6,384. Valves of wireless transmission systems. Edison-Swan Electric Co., C. E. Hiatt and W. J. Davis. April 15th, 1918. (129,051.)

8,779. Electric motors for use on continuous current or alternating current circuits. F. H. Robinson. May 28th, 1918. (129,060.)

9,075. Alternating current dynamo electric machines. British Thomson-Houston Co., H. W. Taylor and J. Whitcher. June 1st, 1918. (129,068.)

10,548. Electric generator for motor vehicles. J. Gambs. July 2nd, 1917. (117,263.)

10,658. Electrolytic cells. H. C. Jenkins and C. I. Syndicate. June 28th, 1918. (219,083.)

10,687. Electric railway systems. E. J. Patelski. June 28th, 1918. (129,086.)

10,771. Apparatus for obtaining high-tension one-direction currents from three-phase currents. O. M. Corbina and G. C. Trabacchi. June 29th, 1918. (129,092.)

10,791. Electrical generators and electrical motors. J. Shepherd. July 2nd, 1918. (Cognate application No. 21,363/18.) (129,094.)

10,857. Control of electrically propelled trucks or like vehicles. P. A. H. Mossay and Mossay & Co. July 2nd, 1918. (129,103.)

10,877. Electric batteries. S. L. Price. July 2nd, 1918. (129,104.)

10,962. Electric motors for operating cranes and hoisting appliances. H. Williams and Simon, Ltd. July 4th, 1918. (129,112.)

11,084. Spark plugs. R. Champlin, H. A. Todd and R. G. Cook. July 5th, 1918. (129,116.)

13,025. Means for holding electrodes used in soldering and depositing metals by the electric arc. Alloy Welding Processes, Ltd., and E. H. Jones. August 10th, 1918. (129,155.)

13,520. Combination night light and electrical heating apparatus. T. G. F. Jorgensen. August 20th, 1917. (118,416.)

14,350. Electro magnetic separator. W. E. Poole. September 4th, 1918. (129,166.)

19,031. Electrical transformers. Siemens Bros. Dynamo Works, J. W. Howard and L. D. Morphew. November 30th, 1918. (129,198.)

1919.

2,710. Terminal electrical connections suitable for sparking plugs for internal-combustion engines. C. F. Burton and H. Burton. February 4th, 1919. (129,221.)

5,461. Electric contact device. A. C. E. Hojgaard. March 9th, 1918. (125,205.)

7,345. Radio-oscillation generators. W. J. Mellersh Jackson. (A. Taylor.) March 24th, 1919. (129,238.)

A New Galvanoset Element.—The Medical Supply Association, Ltd., reports that it has made an important improvement in the conducting elements of the galvanoset water resistance apparatus, which has already been described in our pages. In the past the four conducting elements were made of carbon, but it was found that the positive element was liable to disintegrate, which resulted in discoloration of the water, and necessitated frequent changing of the water and replacement of the element. This disintegration is now entirely overcome, it is claimed, by an element which has been introduced, and which is made of platinum for the positive pole. The Medical Supply Association would be pleased to hear from those of its clients who are using the galvanoset apparatus, in order that arrangements might be made for adopting this improvement.